

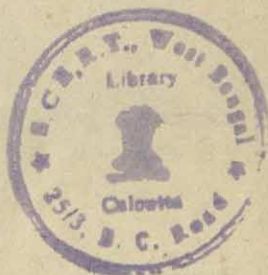
ENVIRONMENT MANAGEMENT IN INDIA

(VOL. I)

Edited by
R.K. SAPRU

Foreword by
T.N. KHOSHOO

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Foreword

At one time environment meant only sanitary and public health engineering, but today the frontiers of environmental management are indeed ever-widening. These involve all basic and applied sciences, all forms of engineering, sociology, economics, ethics and law. The centre of environmental management is constituted by the living systems including humankind. Thus, everything that ensures the well-being of such system comes under the purview of environment.

Environment in India is by and large still over-shadowed by the "doomsday" populist approach. The purpose of environmental management is to develop it as a serious subject with a positive approach enabling us to wipe out the huge ecological deficit on the one side, and prevent future environmental damage by making development sustainable on the other. This is the challenge before us, and the techniques and tools developed in the West may not be entirely relevant to our situation.

Dr. R.K. Saprú has taken a lead in editing the two volumes which I hope will be read by all those who are interested to bring about sustainability in our developmental process as also have clean and healthy environment.

T.N. KHOSHOO
Distinguished Scientist

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Introduction

There is no longer any serious deliberation against the proposition that the natural environment is rapidly deteriorating. It is suffering increasingly from the consequences of man's actions, either productive or consumptive. Discharges into the environment are caused by the pollution of air, water and soil and the inhabitants of these regions. Since prosperity has been growing continuously, the emission of polluting materials into the environment has continued incessantly. It is the growing populations and their continuing demands expressed through science and technology that are compelling modern societies to manage man-environment relationships. Through exploration, migration and unlimited reproduction, man has in effect occupied most of the space readily available to him in the finite earth. His freedom of choice is now threatened with diminution by his stress on the finite aspects of the environment.

Man has become the leading cause of environmental problems. And an environmental problem is anything that keeps him from being healthy and happy. He is now discovering his own responsibility for the harm he has done to the natural environment. And that in order to correct such imbalance (between the nature and man), unhealthy and unpleasant conditions, he must understand his own environment. Man is at last beginning to realize that his own health and well-being and the fate of future generations depend on his action to avert environmental crisis. In the early 1970s he is finally aware of the fact that an hospitable environment is not guaranteed forever, that it is his most precious source, and that he has done much to degrade it.

The premise of collection of papers is that man is faced with a rapidly growing conditions of stress on his environment that threatens his welfare and even his survival, and that people

attitudes and public institutions find difficulties in coping with this circumstance. The demands of modern society on its environment have reached a magnitude that will require a systematic management of man-environment relations, if mankind is to derive continuing satisfaction and support from its environmental resources. It is stressed that a human society without environmental pollution is possible—a society that relates non-destructively to its natural environment and is organized in such a way as to provide each individual with a healthy personal living. This proposition implies far-reaching changes : changes in the popular attitudes, in the organization of government, in the relations between governmental and non-governmental organizations, and above all in international institutional arrangements.

In these two volumes the environmental challenges to modern society has been assumed, and the focus is on the public response. Its concern is mainly with the policies and tasks with which the operations of environment management are concerned. The major task of policy for environmental relationships is to formulate objectives and procedures that meet human needs without impairing the self-renewing capabilities of nature.

Research advances in environmental monitoring and biological sciences combined with harsh experience in national and international economic development, have drawn the world community to an attention that its own health and even survival depend on action to avert environmental catastrophe. This new understanding has helped to bring into sharper focus the interrelatedness of the environment. The purpose of this collection is to engender a broader appreciation of the central role of environmental issues in the wider socio-economic context. This collection is intended as an optimistic thrust at the environmental despoliation. It is not to say that the environmental crises are unreal as some have argued. It is not to say that solutions are imminent. It is not even to say that adequate actions have been set in motion. It is simply to emphasize that the issues are so grave that man must solve them or become extinct from suffocation in his own wastes. It is meant to facilitate a more comprehensive approach by

demonstrating that social and economic problems cause environmental despoliation which, in turn, makes economic and structural reforms more difficult to achieve. Breaking the vicious circle requires increasingly attention from public, government and non-governmental institutions at the national level and international institutions.

I would like to express my deep sense of gratitude to the kindness of all the contributors who worked on the studies contained in these two volumes. Without their unstinted co-operation, this work could not have been completed.

R.K. SAPRU

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Dated : 29-4-1987

1

Cities and Human Environment (A Study of Ludhiana City)

V.P. DUBEY*

Urban environment in India has been worsening as a result of growth in population and undesirable pattern in development. So far as the Punjab State is concerned there has been lot of expansion in urbanisation all over the State. This position would be indicated by the Table given below:

District	Urban population as per cent to total population in	
	1971	1981
Gurdaspur	20.3	21.69
Amritsar	29.1	32.97
Kapurthala	22.04	29.97
Jalandhar	30.3	35.32
Hoshiarpur	12.3	14.44
Rupnagar	14.2	21.58
Ludhiana	35.00	42.01
Firozpur	19.9	22.79
Faridkot	—	23.02
Bathinda	20.0	22.68
Sangrur	20.4	22.81
Patiala	26.3	29.59
India	—	27.68

Similarly the population of the three important urban centres increased tremendously as shown by the Table given below:

* Registrar, Punjab Agriculture University, Ludhiana (Punjab).

City	Year 1971	Year 1981
Ludhiana	401,124	6,07,000
Jalandhar	296,103	4,08,000
Amritsar	434,363	5,94,000

This indicates increasing concentration of the population in these urban areas.

The extent of urbanisation in cities located on the Grand Trunk Road has been more marked. Among the three corporation cities, *i.e.*, Amritsar, Jalandhar and Ludhiana, the extent of urbanisation has been the maximum in Ludhiana in the decade 1961-71. The population of Ludhiana increased by $2\frac{1}{2}$ times and the area under urbanisation increased five times. After Dhanbad in the State of Bihar, Ludhiana registered the highest increase, so far as urbanisation is concerned. However, it has created several problems of environmental management. The quality of life in the newly urbanised areas of the State is abysmally poor. Unfortunately the areas which came under urbanisation were low lying areas located on the existing periphery of the town limits and had no system of proper drainage. The people who urbanised these areas were either the people who came from Pakistan or were migrants from other districts and cities. They had come to the city to eke out a living from the large scale industrialisation of the town. So far as these residential areas were concerned two types of activities were noticed :

- (a) As these localities were earlier used as brick kiln sites, so their development upto a desirable standard for providing the basic infrastructure of civic amenities involved huge expenditure which was not possible either for the municipal committee or for the Improvement Trust.
- (b) Some of the people started running industries in these localities and hence clear cut demarcation of areas as residential and industrial was rendered difficult. Because there was no other agency like the Urban Development Authority at the city level or at the State level, as such these areas remained unattended and over a number of years these have become the worst slums of the town.

The Planning Commission appointed a Steering Committee to look into the problems of urbanisation in this fast growing town of the State. On the recommendations of the Steering Committee, an organisation known as Environmental Research Planning and Design Organisation was created. This organisation submitted a report called the Integrated City Development Programme. A careful perusal of the report indicated that though it had made recommendations for ensuring future development of the designed line yet it failed to make an in-depth study of the problems resulting from environmental pollution. Y.P. Kakkar and N.C. Bhatnager on the basis of their study had concluded that rapid industrialisation of Ludhiana units had resulted in ground water pollution at several places as the water percolating into the soil contained several pollutants. Monitoring of sources of contamination revealed that untreated effluents from industrial units, connected with manufacturing of bicycles and ancilliary parts, electroplating, steel foundaries, was causing maximum pollution in the areas surrounded by such factories. These effluents are percolating into the soil after getting collected in shallow pits and seepage into soil, and vadose zone was taking place every day. At the present moment, soil texture is such that these contaminated pollutants have not reached the depth from which the drinking water is being received. The situation is also being saved because of the unconsolidated sand, silt clay, canker and their intermixture in various proportions in the soil itself. The dilution, filtration, absorption and precipitation of the pollutants has also its limitations. This attenuation capacity is not unlimited and hence a day may come when the ground water supply of certain areas in this town may get contaminated by the toxic ingredients present in these industrial effluents percolating to the soil in the untreated form. Already copper and zinc have reached the saturated state which shows that the soil and the vadose in respect of these elements have become saturated and further pollution is possible with the high concentration of nitrate, cynates and trade elements like chromium and iron. High concentration of chromium is linked with ulcer, dermatitis, and various other health hazards may also cause lung cancer as per the medical advice of experts in the field. Cyanite which can be lethal due to inhibition of cellular

respiration has also been recorded between 1.5 to 2.0 mg. litre at several places. Not only the ground water has been affected but even the surface supply of water in the flowing waters of Budha Nala and the Sidhwan Canal have been contaminated. The health hazard posed by the flowing water of Budha Nala and the Sidhwan canal has been very well pointed by Azad. Though the direct discharge of pollutants into Sidhwan canal has been stopped because of the hue and cry from the adjoining localities, the same cannot be said about the Budha Nala. Even today the water of Budha Nala is being used for various purposes like washing of vegetables, clothes, etc. And which are becoming the carrier of the physical and chemical pollutants present in the water used. The State Government has so far failed to stop the discharge of the polluted water to this flowing stream of water. The Water Pollution Board constituted under the Water Pollution Act 1976 has the power to prosecute the municipal committee like an ordinary individual and thereby compel it to stop the direct discharge of polluted effluents into this flowing stream. As the alternative trunk sewer along the Budha Nala has not been completed, the possibility of the Board/Corporation closing their eyes to this gross neglect cannot be ruled out.

A study has already indicated that 22 tubewells and 4 reservoirs are already located in the areas which have been affected by pollution. It is thus apparent that the polluted effluent can get mixed up with the water which is the main source of water supply for these tubewells at any time resulting in the worst tragedy.

Not only the health of the people is being endangered from this situation but a greater danger is being posed by the extent of pollution of the atmosphere. At present, no study has been made of the sceneries of the city so far as gaseous pollution is concerned, but the foregoing Table will indicate the extent of gaseous pollution being caused by the various sources in the U.S.A.

Ludhiana which is being called the Manchester of Asia, will shortly reach the pollution level of other cities because of its rapid industrialisation. Maximum pollution of the atmosphere is taking place because of half burnt fuel in vehicular machinery. The number of vehicles plying on the Ludhiana roads has

Source	Carbon monoxide	Sulphur Oxide	Nitrogen	Hydro Carbon	Particulates
Transportation	70.2	0.4	8.0	13.8	1.2
Fuel consumption	1.9	22.0	7.5	0.7	6.0
Industrial Processes	7.8	7.2	0.2	3.5	6.0
Water Disposal	4.5	0.1	0.7	11.4	1.2
Miscellaneous	1.2	0.6	0.2	4.2	—

Note : Figures in M. Tons per year.

increased from 2,309 in the year 1969-70 to 62,987 in 1981 and as per my estimate it is shortly reaching the figure of 1 lakh. At present there is no effective legislation to check this menace. The extent of pollution being caused by the transport sector can be better left to the calculation of the reader. On the basis of the above Table, the corresponding analysis of USA shows that the most dangerous pollutant is this sector which is contributing 70.15 per cent of the carbon monoxide in the atmosphere. Similarly, the problems of pollution resulting from fuel consumption, industrial processes and waste disposal are also not being tackled with urgency and the attention which they deserve. The problem of checking pollution from vehicles is more vital than the pollution from industrial processes, fuel consumption etc. The serious neglect of these dangerous pollutants can be attributed to utter neglect and lack of awareness among the people at large.

The measures taken to improve the waste disposal system in Ludhiana have been found to be totally unsatisfactory. Though in the recent past steps have been taken to mechanise the removal system yet the extent of implementation of the various proposals has been only to a limited extent. As early as 1974 the expert committee had proposed the installation of compost plants, and a very attractive scheme had been given to the corporation to raise the resources of this very desirable project but so far nothing has come out and the system of disposal remains almost the same as it was decades ago. Even for

improving the removal waste, the augmentation of fleet has not been up to the desired standard as per Table given below :

This shows that the corporation authorities did not have the requisite number of vehicles for ensuring removal of the solid waste properly and promptly. The net result is that the solid waste remains collected at various spots of the city for longer durations which causes not only nuisance to the public but also poses a serious health hazard.

Strength of Vehicles in Health Department

Type of Vehicle	Strength in 1974	Added during 1974-82	Auctioned since 1974	Actually Required
Tractors	32	2	1	4
T.M.B.	2	3	1	—
Tipper	3	1	—	3
Loader	—	4	—	—
Roadsweeping machine	—	2	—	—
Lay Land Trucks	—	2	—	1
Handles	—	2	—	4
Tugger	—	2	—	—

Under any effective city management, the sullage effluent should be used for minor irrigation purpose. This will provide not only a cheap source of fertilizer but will also prevent pollution of underground water and also give a longer life to the sewerage system. Thus before putting such polluted effluent into the city sewerage system, it should be treated and pollutants removed. The Water Pollution Act made installation of treatment plants by the industrial units a legal obligation. But so far the implementation of this Act has not been very satisfactory because the persuasive methods have often failed to motivate industrialists to go in for installation of treatment plants. In the beginning, the implementation of the legislation was delayed because the rules were not framed by the Government and without rules the Act could not be enforced. The result has been that pollution problems are arising not because of industrialisation *per se* but because of their wrong location. We have not been able to properly plan industrial areas and also to

effectively bifurcate the industrial areas from residential areas. We have not even cared to create green belts which could help in diffusing and diluting the atmospheric pollution before the pollutants reach residential areas. It is an admitted principle that industry should be located at such a distance from the residential areas so that by the time the smoke reaches the residential localities, it is sufficiently diffused. Unfortunately our planners have planned residential areas quite adjacent to industrial areas and if this is the position in the planned localities of the town, then the position of the unplanned localities can be well imagined. The West German Government passed legislation for abatement of industrial pollution, the severity of which is unparalleled. The law applied not only to the new installations but to the old units as well. Despite cries of ruin raised by owners of old factories they were required to reduce emission to about 26 noxious substances. New regulations regarding emission of heavy metal such as lead and cadmium was to be reduced from the present limit of 20 mg. per cubic metre to the prescribed limit. Emission of dust was to be reduced from 500 mg per c. metre to 150 in the case of small factories and from 150 mg. to 50 in the case of large installation. The industrialists resisted but the then West German Minister declared that, come what may, the legislation will have to be implemented. He further remarked that the industry will have to find the money to invest in the new anti-pollution equipments. It may appear strange to hear from a Minister in a business oriented Government but it reflects the very serious concern for environmental issues in Germany and all this shows the growing influence of environmentalists. Our Government which swears in the name of a Constitution which even in its pre-amble proclaims welfare of the people to be the goal to be achieved by all governments established under it, but so far all governments have failed to implement the legislation enacted in this regard.

Rightly the ecological problems have been categorised under the following two heads :

- (a) problems arising from the action of man ;
- (b) problems resulting from the action of God or acts of nature.

The ecological problems resulting from the action of man are sometimes justified in the economic development. The purpose of making economic development can again be categorised under two heads:

- (a) Effort to improve the income of the man ;
- (b) Effort to improve his living conditions.

Unfortunately our Government has been placing emphasis on improving the income of the man and not on improving their living conditions. This is not a desirable objective if viewed from a correct perspective. Most of the ecological problems of the city management arise from the action of individuals or group of individuals who wield influence at levels that count and hence the problem. These can be tackled only if the Government shows the requisite degree of firmness and is prepared to ignore the pressure of the vested interests.

A study by B. Bowonder on Management of Urban Environment concludes on a grim note of warning. Reorienting the existing trends of growth and undesirable patterns will be resisted by the existing groups since institutions are nothing but social groups which have intensive interest in self preservation and survival. Organisations tend to resist remaking themselves and only through designing of newer institutions, caring for public participation and system planning, urban environmental quality can be improved. This will not be possible without sincere public participation and political leadership with commitment. If the existing patterns of growth continue, urban crisis of catastrophic dimensions will prevail in urban settlements.

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Development and Management of Environment Through Topographical Maps

G.S. OBEROI*

Introduction

It is heartening that the subject of Environment has attracted considerable attention, in recent years. When we think of Environment, the things that instantly come to our mind are, air, land, water, wild life-animals, birds, fish and forests, etc. These really constitute the physical attributes of an Environment. I, however, firmly believe that the Environment is not complete, unless it also includes equally important social and human parameters such as, human welfare, social justice, safety and security, health, education, culture, job opportunities, and above all, love and peace. Obviously, when we are striving for the preservation of Environment, if it has to have a practical and real MEANING to our people, it must include the basics of life which they lead. For instance, the beautiful and scenic natural surroundings, pure air and clean water, would be meaningless to persons who cannot afford even two square meals a day, do not have adequate clothing to protect them against winter, have no shelter against wind, rain, sun and storm, no proper medical care, no relief from the drudgery of collecting fuel wood, fodder, or even drinking water and no assured job or employment ensuring sustained means of

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livelihood. In India, these parameters assume even greater importance, as a large majority of our people still live below the grinding poverty line, and find it extremely hard even to make both ends meet for their very existence. In view of the pressing need to bring about qualitative and quantitative change in the life of our people, to provide them some worthwhile employment which would enable them to live with reasonable satisfaction of their basic needs, there is a great and inescapable need for rapid, all-round, integrated and balanced development of the country. That is why, I have chosen to write on the subject of Development and Management of Environment, rather than Environment by itself. In fact, I would not be far wrong to state that, in our country, the improvement of Environment itself implies and demands that the development to make the means of livelihood accessible to the teeming millions of our people should take place quickly ; and whereas, in the Western countries, the accent is on ensuring that the economic and industrial development does not endanger the natural Environment, so that the elements of water, air and land remain pure enough for consumption, on the other hand, in our country, the more serious problem of development itself needs very urgent attention.

Development with Concern for Environment

In view of the fact that development of an area requires provision of more irrigation facilities, generation of more energy—Thermal, Hydro-electric and Nuclear, setting up of huge factories for production of steel and cement, the essential infrastructure needed for completing the various development projects, setting up of industries for capital and consumer goods, provision of road/railway/water and air transportation services etc., all this is bound to pollute the atmosphere, water and land, unless there is an effective regulatory control on resource development and for the proper disposal/treatment of wastes, etc. Whereas about half a century ago, little thought was paid to this aspect as the industrialisation had not reached a precarious limit, yet the present stage is so dangerous that unless strict and sustained measures are adopted for continued preservation of our fragile Environment, we may damage our

very abode, the Earth which supports us, to such an irreparable extent that life on the planet may become well nigh impossible. There are ample examples of this near at home, in Bhopal—the tragedy of a chemical gas leak resulting in the death of over 2,000 human beings and untold miseries to many times more. The Nuclear weapons being created and stock-piled thoughtlessly by Nations who possess this capability (with other Nations aspiring to acquire this capability), are a constant and real threat to the very existence of humanity—nay the entire life on this Planet. It is not very long ago, that man considered Nature comprising of fathomless seas, towering mountains, icy glaciers, vast desolate deserts, thick impenetrable jungles, as an opposing, ferocious and antagonistic entity, which he fought to CONQUER, but it has now become obvious that man is more ferocious and in fact, so perilously dangerous that his own life (mankind itself) is now threatened with extinction. The World was earlier considered to be too big, and many lives were lost to cross over the high seas in the discovery of islands, and to overcome the forces of nature, but today the World has become so small (thanks to miracles of Science), that happenings at any point of the globe can be vividly viewed through the media of T.V., and communication can be established even with other Planets encircling the Sun. It is, therefore, very heartening that national and global societies are now paying attention towards this very important aspect of ensuring the continued existence of life on this Planet. There is obviously no doubt, that if humanity is to survive on this earth, all the Nations must join hands and create a global society in which the entire mankind strives to co-exist with peace and dignity, and stops this ever confrontation between Nations.

Topographical Maps

We have to plan the development, management and consumption of our limited resources, so that these could be used for all time to come, without killing their inherent power of regeneration. We have to use them in an optimal fashion, and an effective control has to be exercised, so that their proper maintenance and health are regularly monitored systematically.

No developmental planning can be done without a topographical map on a suitable scale with appropriate contour interval, to enable a complete study and assessment being made of the capability of the terrain/water/soil and all other available resources. Here, I would like to dilate somewhat, on the subject of topographical map.

A Topographical map is a map on a sufficiently large scale on which the various individual ground features—both natural and cultural (man-made)—are depicted in their correct relative positions, with the height information/profile being depicted by contours (lines connecting places of same height above mean sea level). It is a complete and authentic inventory, spatially arranged in correct relative relation to each other, of the total land cover information of an area, including all important man-made and natural features. A Topographical map may, thus, be described as a scaled model of the surface of the earth, which it depicts, and affords accurate quantitative measurements being made for the purpose of any developmental planning. It, therefore, also enables a ready and reasonably accurate evaluation of the status of physical environment over an area, as, the presence or absence of forests with their type, the density of population, the state of industrial and economic development, the existence or otherwise of factories/chimneys, the contiguity to seashore or otherwise, the latitude, the height of the place above mean sea level, the direction of hills/ridges, the type of terrain, landuse pattern, etc., can be readily determined. This information combined with other observed data, such as the temperature, humidity, direction and speed of wind, the rainfall, the installation of any factories. etc., would of course, complete the picture.

Progress of Topographical Surveys

The survey of India, presently under the Ministry of Science and Technology, Government of India, has been carrying out topographical mapping of the country for use of all sections of society—Planners, Administrators, Foresters, Engineers, Road and Railway Authorities, Defence Authorities, Educationists, Scientists, etc., since its inception in the year 1767.

After attainment of our independence, the resources of the

Survey of India had to be increased manifold to meet the inescapable need for special large-scale surveys, urgently required for a large number of multi-purpose projects included in the successive Five-Year Plans, with a view to increase agricultural and industrial production essential for the economic uplift of our people. The present position is that the basic topographic surveys over the entire country on 1 : 50,000 scale (the scale adopted in lieu of the earlier 1"=1 mile scale, after the enactment of the Standard Weights and Measures Act, 1956) have since been completed. However, in view of the burgeoning demand of numerous developmental authorities/agencies all over the country for larger scale maps for their planning and development, it has been decided by the Government, to adopt 1 : 25,000 scale for providing the basic topo cover for the entire country, in a phased manner, and in fact, some areas have already been covered on this scale. In addition, larger scale surveys on 1 : 15,000, 1 : 10,000, 1 : 5,000, 1 : 2,000, 1 : 1,000 and even larger scales with closer contour intervals, have also been carried out in certain areas of the country, for various indentors on their specific demands. Since 1950, the department has been actively involved in about 500 development projects spread all over the country, and it may be stated that there is no development project worth the name, which has not been based on the topographical maps prepared by the Survey of India.

Environmental Control Before Approval of Projects

The Study of topographical maps covering an area on 1 : 250,000/1 : 50,000 (and also on 1 : 25,000, where available) would enable the authority concerned with the clearance and final approval of Projects, to decide on a rational basis, taking into account all relevant factors including terrain characteristics, as to whether or not to allow a particular industry or other development project to come up in a particular area consistent with maintenance of healthy environment. The regulatory or approving authority must also ensure before any sanction is given for the erection of a factory etc., that adequate and proper safe guards are statutorily provided

for proper disposal of exhaust fumes, effluents, etc., so that the quality of environment is fully protected and maintained.

Topographical Map in Development Planning

The topographical map enables the planners/engineers/other concerned authorities to have complete and accurate data of the ground before them, to enable them to take a decision regarding development planning and to pick up the best of various alternative options available to them. Further, any developmental decision concerning an area would normally have some bearing/implications on an adjoining or other area, and it would really serve no purpose—and it may, in fact, be counter productive—if by trying to improve or develop a particular area, we do not consider its adverse effects, if any, on other areas. The topography of an entire river basin should, therefore, be thoroughly studied for any development decision. Topographical maps, produced by the Survey of India, provide the answer, and these on scales 1 : 250,000 and 1 : 50,000 for initial studies for identification of schemes, and on larger scales with small contour intervals, specially prepared for detailed project reports, are essentially required, whenever the economic and technical feasibility of any Project is to be determined—be it connected with Irrigation, Hydro-electric power generation, Integrated Area Development, Town and Country Planning, Forestry, Soil Conservation, Tourism, Installation of a Steel or Thermal Plant, Laying of Roads, Railways, Pipelines, etc. In a way, we may say that the Topographical map, at once, transforms the user of the map to an omniscient being, with powers to view the entire area, as if he were observing every feature therein, correct to scale, vertically from above. This, information, indeed, is invaluable in all assessment and planning. A Topographical map, thus, is a commodity of wide and varied application and everyone—to whatever walk of life, he may belong—would be greatly benefited to make use of the Topographical map of the area in which he operates. Once he gets the map and studies it, he will soon find it indispensable, as it is a complete and accurate record of all land and land based information (at the time of survey), so essential to him for his various uses. In fact, it

would be very useful, if the Topographical map of the area in which a particular school falls, is used for general education of the students, for the proper development of their faculties of observation and appreciation of the natural resources and environment around them.

Preservation of land

Land and the Soil are an invaluable resource for survival of man on this earth. Land is comprised of varying terrain features, and for the best use of this resource consistent with conservation of soil, the topographical map which depicts the area accurately (including the height information, by contours), is a must.

Unless adequate measures are included in our land management practices to protect the soil from erosion, a stage may soon come when there is no soil left on top of the underlying rocks, to support any life—human, animal or botanical, on the surface of this earth. It takes centuries for the life-giving productive soil to form by the natural processes, but we can lose it quickly through our carelessness and faulty agricultural practices.

In fact, it would be desirable to study the trend of environmental changes in an area by a simple comparison of a print on transparent medium from a topographical map of an earlier period available with the Survey of India, with the latest map, and decide on any action plan that may be warranted. For example, the extent of deforestation in any area could be determined and convincingly demonstrated for creating stirring awakening among the public. The Topographical maps are essential for deciding on the appropriate measures to be adopted to ensure, that the land is used and maintained as a renewable resource. The gradient of the land under study is some times required as one of the important factors for consideration, and this can be systematically studied from topographical maps. It is also essential that the drainage system should be adequate to ensure proper draining out of excess irrigation or rain water, to avoid the land getting water-logged. Long bunds for protection against floods, or embankments of roads and railway lines with-

out proper cross drainage can also be a fertile cause for generating waterlogging problems.

Water Conservation and Management

Another most important resource, which needs to be looked after for the proper maintenance of environment is water, which is required for industrial, irrigation and domestic purposes. This being an absolute basic need for existence, it must be ensured that adequate quantity of safe and unpolluted water is made available to all—whether they live in cities or villages. Of late, this need has assumed great urgency, as somewhat uncontrolled industrial development, without proper disposal of toxic wastes and effluents from factories, is causing fast deterioration in the quality of water of our rivers—so much so, that water in certain portions of the river is poisonous and is lethal both to human and aquatic life, and may not be good enough even for irrigation. Therefore, adequate legal and administrative measures must be instituted to ensure that those responsible for running of industries/factories are effectively stopped from dislodging their refuse and other toxic material, into the streams and rivers, without proper treatment. Unless this is done, the very survival of man on this earth is seriously threatened. Here, again, as far as the study for optimal use and management of water resources is concerned, the topographical sheet is an essential pre-requisite. The information regarding the source of water, the length and width of river, and the places where water samples may be collected for the purpose of testing for proper monitoring of anti-pollution measures, and the total terrain characteristics of a basin, can easily be obtained from the Topographical map. The Topographical map, with the additional hydrological data regarding precipitation, the quality and the quantity of water available, etc., is necessary for any scientific development/management of water resources. In fact, it is the topographical map with small contour interval specially prepared by the survey of India, which also enables the authorities to decide the extent to which an area is likely to be flooded and to take remedial measures for flood control measures/rescue operations, etc.

The Survey of India toposheet, by virtue of its information

contents presented in a graphic form, in correct relation to each other, is ideal for a complete assessment of the land and water resources in a region, for their best use for the integrated development of the area, consistent with preservation of proper environment.

Aerial Photography

Further, the aerial photographs which to-day, form the basic input for the purpose of all topographic mapping, can be used to great advantage both for updating the map for any information which may have appeared after the survey, and for obtaining thematic information pertaining to geology, forestry, soil, hydrology, etc., which are also essentially required for environmental mapping. Large scale photography (on 1 : 10,000 scale and larger) taken at frequent intervals, for human settlement areas is ideal for planning and monitoring the rapidly changing urban environment. Provision for quick and cheap photography on small format (35 mm) which should be freely available to the users, for urban development should go a long way, in meeting this need.

Suggestions

(a) In view of the great potentiality of topographical maps and aerial photographs, for the planned development consistent with maintenance of proper Environment in an area, all Governmental and other Agencies concerned with development and environmental protection and improvement should maintain a library of all such maps and aerial photographs, alongwith some simple instruments such as stereoscopes, etc. required for the purpose. The pamphlet, 'Aerial Photography—An indispensable tool for developmental planning and surveys' which gives very valuable information for the purpose, may be obtained from the Surveyor General of India, Dehra Dun/Director, Survey (Air), Survey of India, R.K. Puram, West Block No. 4, New Delhi.

(b) Short duration orientation courses in map reading/interpretation, photo-interpretation and Remote Sensing from

satellite imagery, should be available for those directly concerned with Development and Environment.

(c) The information on availability of Topographical maps, on 1 : 250,000/1 : 50,000/1 : 25,000 and their use not only for Environmental studies, but also in all other fields of our National activity, should be widely disseminated through Exhibitions/Symposia, Regular programmes on TV/All India Radio and popular articles in Newspapers/Magazines, etc. Topographical Maps of all areas of the country should be freely available for use by all concerned for development, planning and environmental preservation, by omitting therefrom information of security, if any.

(d) Statutory provisions must be made in all development projects to ensure maintenance of healthy environment. The regulatory authority should be made responsible to ensure this, at all stages of a Project—Feasibility studies, Detailed planning and project report preparation, Approval, Execution and Operation.

(e) Topographical maps of the local area should be prescribed for general and environmental education in all Schools, for students of Classes VIII to X. This would ensure full development of their faculties of observation, appreciation and analysis of natural resources, and their proper development/management.

(f) Maintenance of Civic Environment is equally important. The School children, especially in our urban areas, should be involved in mapping the same. Such an exercise would make them directly aware of the local problems of civic environment, such as traffic congestion, ill-maintenance of roads, unhygienic conditions in public places, wasteful flow of water/power, etc., and they would then get naturally motivated towards bringing about improvement, through voluntary and collective effort.

Environment and Transport Pollution

(A Study of Environment of State Road Transport Undertakings)

BIDHI CHAND*

The working of an enterprise is affected by a number of factors which for the sake of convenience of study can be divided into two parts—controllables and environmental. The controllable factors refer to those factors which are within the control of a manager and constitute basically his own functions of planning, organisation, staffing, direction and control. Environmental factors are outside the control of a manager. This study basically analyses the second category of factors, *i.e.*, environmental factors. First part of the study gives a general view of business environment and the factors constituting it. In the second part the environmental factors affecting the working of State Road Transport Undertakings in India have been discussed. This has been followed by concluding remarks in the third part.

Part A : Business Environment—The Concept and Constituent Factors

The term environment, according to dictionary, refers to surrounding objects, regions or circumstances. Though it is

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only recently that study of environment has assumed importance because of the realisation of injurious effects that pollution, floods, draughts and some other aspects of environment have on human life, yet in relation to business, attempts at its understanding and planning have been made for more than half a century now. Understood in relation to business, environment or to be more specific business environment may be said to comprise objects and circumstances which affect or influence business operations. Business operations constituting production, finance, personnel management and marketing functions are affected or influenced by a large number of factors. For the sake of convenience of understanding and analysis, these factors are generally referred to as economic, legal, political and cultural factors.

Important economic factors constituting economic environment of business include programme of economic development, economic infrastructure, Government economic policy, population, etc. Legal factors are the laws, rules and regulations made by Government. Industries Development and Regulation Act, 1951, Monopolies Restrictive Trade Practices Act, 1969, Capital Issues Act, 1947, Import & Export (Control) Act, 1947, Foreign Exchange Regulation Act, 1947, Factories Act, 1948, Workmen's Compensation Act, 1923. The Payment of Wages Act, 1936, etc. are various Acts affecting business in general. They may be said to constitute legal business environment. Support or hostility of the politicians who make the Government, stability or instability of the Government etc. are the political factors constituting political environment of business. Cultural factors would include factors like peculiar social conditions, apathetic and indifferent attitude of workers, superstition, customs, considering dependence of success or failure of an enterprise upon merry and pleasure of some special god, resistance to change, etc.

These various economic, legal, political and cultural factors constituting business environment may have positive or negative effects on the working of a business enterprise. When the effect is positive, various elements of business environment offer an opportunity for the growth of business. Increase in income and population, for example, offer an opportunity for increase in sales of a business enterprise. So does the favourable



support of the politicians who constitute the Government. They may give various tax and other concessions. As regards religious and cultural factors, increased demand for turbans, due almost to compulsory wearing of turbans by Sikhs who constitute a majority in Punjab, may be said to be due to these factors. Elements of business environment may also pose a threat to business. Political instability and communal disturbances are a great hurdle in the growth of business. Business units start migrating from the areas where there are political instability and communal disturbances. The sales of certain goods is very adversely affected. Mobility of the people is also reduced due to danger to the life and property. Some time cultural and religious factors pose a threat. Sales of tobacco and cigarettes in Sikh dominated areas are bound to be low as Sikh religion does not permit their use. Similarly, beef will not sell in Hindu dominated areas. Among economic factors, a fall in income of the people due to one reason or the other will also reduce sales in general. So will MRTP Act restrict the growth in size of a business unit. All these go to illustrate how business environment may pose a threat to business.

Part B : Environmental Factors Affecting State Road Transport Undertakings

(i) Economic Factors

The adoption of Socialistic Pattern of Society as the objective of economic and social policy in India led to the adoption of Industrial Policy Resolution, 1956 by the Indian Parliament. This Resolution though elaborated and modified by adopting various Industrial Policy Statements from time to time, still forms the basis of the Industrial Policy of the country. This Policy Resolution has divided various industries into three categories called Schedules A, B and C. Road Transport has been placed in Schedule B, which, in all, includes twelve industries which, according to the Resolution, will be progressively State-owned and in which the State will generally take the initiative in establishing new undertakings. State participation in road transport, in main, started in 1950. At

present there are 53 State Road Transport Undertakings and about 60 per cent mechanised passenger transport vehicles are in public sector. In the Seventh Five-Year Plan preference has been given to consolidation of existing State Road Transport Undertakings than to provide for their further proliferation. Nevertheless, progressive State participation remains the key policy with regard to road transport and, therefore, percentage share of nationalised vehicles may be expected to increase in future in general.

Development of nationalised road transport is intimately connected with the development of roads. Because our economy is still agricultural in character and the settlement pattern is rural oriented, roads are an important element of transport infrastructure. Better roads help achieve fuel economy and improve the productivity of the transport sector. In 1951 the road net work constituted about 4 lakh kms. It has now increased to 17.7 lakh kms. In other words, it has increased on an average by about 4.5 per cent per annum. The length of National Highways is 31,710 kms. and they carry nearly a third of the total road traffic. But the road system is far from being adequate. About 36 per cent of the villages in the country still remain unconnected with roads. More than 65 per cent of the villages are without an all-weather roads. The pavement width of most of the roads is only single lane. The grid as a whole suffers from serious deficiencies. It has been estimated that fuel wastage due to bad roads constitute about Rs. 500 crores a year. As mentioned above the country has 31,710 kms. of National Highways as against a requirement of 65,000 kms. Expressed as a proportion of total plan outlay, the outlay on roads has remained low and all along, as compared to the First Plan, the percentage share has been less. The expenditure on roads as a percentage of national income is only 0.66 per cent in India. In advanced countries, this percentage is 1.5 to 2 per cent. Even in a country like Thailand the figure is 1.44 per cent. All this indicates that road system is grossly inadequate. This definitely is bound to act as a constraint to the development of State road transport in the country.

Trends in percentage of people below poverty line indicate that there has been a decline in the incidence of poverty. On the whole, the percentage of population below the poverty line

was 48.3 in 1977-78. It declined to 37.4 in 1983-84. The decline has taken place both in rural and urban areas. In rural areas, it declined from 51.2 to 40.4 and in urban areas from 38.2 to 28.1. The Sixth Plan had set an aggregate growth target of 5.2 per cent. This target has been achieved. All this points to the fact that State road transport undertakings now have better growth opportunities.

(ii) *Legal Factors*

State Road Transport Undertakings in India are mainly governed by Motor Vehicles Act, Motor Transport Workers Act and Road Transport Corporation Act in addition to various other labour and taxation laws, etc. Motor Vehicles Act considers State road transport undertakings like any other private operator. These undertakings are required to contest their claims *vis-a-vis* private operators before various authorities. As a consequence of this, there is litigation and delay in the process of nationalisation. Further this Act has conceived of a highly controlled and inflexible route permit structure. This is because of the fact that earlier only private operators were thought to provide road transport services. Though later on State road transport undertakings were allowed to operate road transport services by introducing Chapter IV-A in the Motor Vehicles Act, yet the position with regard to route-permit structure continued to be the same *i.e.*, highly controlled and inflexible. This makes scheduling unscientific.

The Motor Transport Workers Act has, by and large, been drafted on the lines of Factories Act, governing stationary workers. This Act seeks to safeguard the welfare of motor transport workers and regulate the conditions of their work. The important provisions of this Act cover registration of motor transport undertakings, inspecting staff, welfare and health, hours and limitations of employment, employment of young persons, wages and leave, penalties and procedures etc. This Act does not pay any special attention to the peculiarities of road transport industry. No attention has been paid to the requirements of long distance, night, express and luxury services. The Act, in fact, was drafted, long before these services became popular. If Motor Transport Workers Act is

interpreted strictly no State road transport undertaking can operate long distance services which are economical.

The road transport corporations have to work within the framework of the Road Transport Corporations Act, 1950. This Act allows considerable scope to corporations to function on commercial lines and enables them to take and implement decisions speedily without being tied down to rigid procedure. But the Act leaves undefined the pattern of Board membership. The Board may be composed of all officials or any combination of the two. On the constitution of the Board depends its inherent capacity for autonomous decision making and commercial functioning. Section 34 of this Act empowers the Government to give directions to such corporations. The specified range of items which such directions may cover is quite wide under the Act. In any case, the degree of residual autonomy of the corporations depends on the frequency and coverage of the directions issued in practice. In an extreme case the corporation can be reduced under the Act to the status of a Department of the Government. Thus under Section 14, the General Manager and the Chief Accounts Officer are appointed by the Government. No wonder then that their primary allegiance is to the Government and they look up to it for progress in their career. Section 30 empowers the Government to determine the use of profits earned by the corporation. If deemed necessary in certain cases, all the profits are credited to the Government like the profit of a Government Department. Under Section 32, the corporation is required to submit its budget for approval by the Government. The conclusion is that the Act does not let the transport corporations enjoy the full measure of autonomy to which they are theoretically entitled and which distinguishes them from departmental organisations.

Various labour laws passed by the Central and State Governments are applicable to the nationalised road transport undertakings. Among the important enactments applicable to these undertakings are : The Minimum Wages Act, 1948 ; The Industrial Disputes Act, 1947 ; The Payment of Wages Act, 1936; The Workmens' Compensation Act, 1923 ; The Industrial Employment (Standing Orders) Act, 1946 ; The Factories Act, 1948 ; The employees' State

Insurance Act, 1948 ; The Employees Provident Fund Act, 1952 ; The Employment Exchanges (Compulsory Notification of Vacancies) Act, 1959 ; and the Apprentices Act, 1961. In addition to this legislative framework, some voluntary steps taken to maintain good industrial relations *e.g.*, the code of Discipline in industry, are also applicable. The Factories Act, 1948, regulates the conditions of workers employed in the workshops for repairs of motor vehicles. Under the Minimum Wages Act, 1948, minimum wages have been fixed by the State Governments for public motor transport workers and are in force in these organisations. These acts naturally impose certain obligations on these organisations and to that extent certain amount of autonomy is curtailed.

(iii) *Political Factors*

Maintenance of law and order and peaceful political atmosphere are essential for plying of buses. Political and other agitations or otherwise disturbed conditions in the country or in any part thereof, are bound to adversely affect running of vehicles. During various agitations Government buses quite often become the target of attack. This disturbs scheduling. Because of disturbed conditions, night bus services are generally curtailed or even totally suspended. Processions taken out by political parties and others cause delays in the running of buses.

Similarly, lack of cordiality in Inter-State relations also adversely affects Inter-State bus operations. During the past few years many such instances of suspension of Inter-State bus operations between Haryana and Punjab have taken place. The political change, resulting into change of Government in the country or in a State may bring about a change in the policy of road transport nationalisation itself. This would become clear again if one studies the statements of ministers about road transport under Congress and Akali Governments.

Politically awakened areas generally become administrative centres and have to be linked with capital of the State by road and even often by rail. State road transport undertaking is required to run buses to connect the new administrative centres with other areas. Political factors affect the State road

transport in another way also. The areas which are represented in State Legislatures or Parliament by important persons, particularly those belonging to the ruling party, get quite often connected with other towns particularly State capital or Delhi, by bus services and if possible by railways. It is no secret that many a time MLAs and MPs and ministers are responsible for introduction of certain transport services between various towns. Thus politicians quite often interfere with scheduling aspect of bus operations of State road transport undertakings.

(iv) Cultural Factors

Among cultural factors affecting State road transport operations the most important is religious fairs or melas. During the religious fairs or melas special vehicles are to be run. Kumbh Melas at Hardwar and Allahabad, 'Kapal Mochan Fair' in Haryana, 'Surya Grahn' at Kurukshetra, Gurupurb at Anand Pur Sahib provide only some of the examples of such religious fairs. These require heavy deployment of buses for carrying passengers to these places during particular periods. In the wake of general shortage of buses and replacements becoming long overdue, deputing buses for these fairs and melas is bound to disturb regular schedules at some of the routes.

Special courtesy or consideration shown to women in a country like India leads to reservation of seats for women passengers. This generally happens in the case of city services. Similarly, free travel or concessional passes may be allowed to certain categories of passengers. Students generally are allowed to travel at concessional rates. There is free of cost travelling for blind people and some other disabled persons. In certain States first three seats are reserved for MLAs and MPs.

Part C : Concluding Remarks

It would be clear from the above discussion that in the case of State Road Transport Undertakings present environment creates more hurdles than it offers opportunities. It is not that

the situation cannot be improved. It can certainly be improved. Motor Vehicles Act, Motor Transport Workers Act and State Road Transport Corporation Act can suitably be amended. These undertakings can be given greater autonomy and decision making powers. Political interference too can be minimised and professionalisation in their management can be increased. An important thing to be realised is that an effort should be made to quantify the loss arising out of the social obligation so that the same is not used as a pretext for hiding inefficiency. This may be beneficial to the management of these undertakings also. Some time their good efforts get concealed behind losses made by these undertakings as, on account of this, they are termed inefficient. As the Seventh Five-Year Plan brings out the productivity trends in these undertakings on the whole show an improvement in their functioning. But a study of profitability in these undertakings will give a different picture. This is paradoxical and is indicative of the fact that losses may not be due to mismanagement on the part of the Undertakings. If the losses incurred on account of social obligation are quantified the whole things can be clearly understood. It may perhaps then become clear that losses increased by these undertakings are, by and large, due to the fact that fares are seldom revised although the cost of operation has gone up many times. The increase in cost of operation is, by and large, due to inflationary conditions in the country. However, the State Governments do not suffer losses. They try to earn revenue by increasing passenger tax and other taxes rather than by increasing fares. Thus, the State Governments get their due but the undertakings get termed inefficient when they are judged from profitability point of view. This is highly unfair and can hardly be justified. The construction and maintenance of roads is a general problem and should be viewed accordingly. This would definitely improve the working of these undertakings.

Environmental Management of Urban Areas in India

L.N. MATHUR*

Introduction

The contemporary scientific and technological revolution has brought in sharp relief, the danger of environmental deterioration to an extent, that may challenge the very existence of man. Society's interaction with nature is so extensive that ecological balance has undoubtedly been disturbed on a vast scale. Environmental deterioration can be attributed to industrialisation and urbanisation, the depletion of traditional sources of energy and raw materials, constant population growth, pollution of natural water resources, the destruction for economic ends of various animals and plant species, the artificial sound amplifiers and other noise-making systems, the use of space for testing destructive machines and the negative genetic consequences of industrial pollutants.

Steady scientific and technological progress has given man unprecedented power over nature. Our productive and economic, scientific and technological activities now extend to outer space. Our destructive capacity in war and defence can imperil life of not only humans but that of all living organisms—flora as well as fauna.

It has become apparent that we cannot, and certainly must not, make unthinking use of the new frontiers of knowledge for encroaching endlessly upon nature and altering it drastically

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without thought for the possible consequences it may have on man and the universe. The greater the benefits we create, the more do we realise that we cannot afford to ignore the changes wrought in the biosphere by our modern production activities. Nature takes its revenge for each of our so called victory over nature.

The production of material goods increasingly involves the depletion of non-renewable traditional natural resources, and the unconsidered disruption of important links between individual components of the biosphere, destroying its life-supporting systems. The environmental question today is thus not simply one of pollution and other negative results of man's economic activity. It also involves changing our uncontrolled impact on the natural world to a conscious, purposeful and planned interaction with it.

System of Controls

In India the problem was given a serious thought by a few environmentalists and the then Prime Minister Mrs. Indira Gandhi. In 1972 she attended the United Nations Conference on Human Environment at Stockholm. In 1976 the Constitution (Fortysecond Amendment) Act was passed and she was instrumental in incorporating provisions therein to protect environment and safeguard against pollution. The problem of environmental pollution was highlighted through inclusion of Article 48-A in the Chapter on Directive Principles of State Policy which runs as follows :

48-A. Protection and Improvement of Environment and Safeguarding of Forests and Wild Life—The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country.

The Constitution (Fortysecond Amendment) Act, 1976 provided in section 11 a new Part IV-A under the nomenclature "Fundamental Duties". It provides Article 51-A in which sub-clause (g) is relevant for the subject under discussion and which reads like this :

"It shall be the duty of every citizen of India . . . to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures."

The effect of including these provisions in the Constitution of India has been instant. There has been a national awareness of the inherent danger in the further neglect of purity of environment and pollution of our rivers and atmosphere. It further gave a legal basis to the State to initiate laws to preserve and protect the eco-culture. As a first step, the Union Ministry of Environment and Forests was constituted. Water Pollution Boards have also been constituted under the Union and State Governments. The Union Ministry has organised a national environmental awareness campaign (NEAC) in order to rouse public conscience against destruction of trees and natural habitat of wildlife that sustains the balance in the biosphere.

As is well known the provisions contained in Part IV of the Constitution dealing with the Directive Principles are not enforceable by any court, but the principles therein laid down are, however, fundamental in the governance of the State. It shall, therefore, be the duty of the State to apply these principles in making laws. The Supreme Court of India has conferred varying degrees of respectability to the Directive Principles from time to time. As time passes the State would perfect the machinery for protecting and improving environment through legal and institutional set-ups on an all-India or State level. What is important is to popularise measures to achieve the end on city to city basis particularly in metropolis and larger urban concentrations for they constitute the major culprits in deteriorating the natural eco-system. The newly fundamental duties have been provided to create public awareness and general consciousness for a healthy environment. The provisions in the chapter on Directive Principles casts a duty on the State while the provisions contained in the chapter on Fundamental Duties enjoins the public to keep the environment free from pollution.

Such principles as are contained in the constitutional provisions are, no doubt, salient but enforcement of law and management of healthy surroundings is by no means an easy

task. It may involve vast expenditure, manpower and public education in order to bring about the desired results.

Concerned at the increasing pollution caused by the industrial units, the Government of India at the national level has issued guidelines requiring all project authorities to incorporate a chapter on their feasibility reports.

A formalised procedure has also been evolved to ensure that environmental considerations are taken into account at the site selection stage itself. The licensing mechanism, which is operated by the Ministry of Industry, is increasingly being used for control of environmental pollution.

The government is armed with a number of statutes to take effective measures in this direction. These are Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Forest Conservation Act, 1980 and Environment (Protection) Act, 1986.

These legislations comprehensively cover the environmental measures that need to be taken and encompassed every area of national activity.

Besides, a massive effort is under way to clear Ganga river of diverse pollutants. On either sides of its banks vast woodlands should be developed under a centralised authority for maintenance and improvement of riparian environment.

The States, however, may not be able to survive economically if they were to provide large-scale institutional support for preserving and improving environment in State, region, district, city and still smaller units. As a practical approach the city should be taken as a unit and the District Magistrate should be made an over all incharge to administer programmes to fight out pollution and maintain healthy atmosphere in consultation with the Chief Medical Officer (or Civil Surgeon) of the District.

Maintenance of Urban Environment

However, basically the duty to maintain ecological balance within the city lies on those who are entrusted under law to manage the city government and health and sanitation programmes. The local self-government, be that Municipal Corporation, Municipal Board, District Board, Cantonment

Board or any other such authority, is charged with the responsibility of maintaining acceptable minimum standards of human dwellings, healthy atmosphere and purity of food and drinking water. In addition to municipal regulations for controlling pollution the responsibility further extends to State and Central Governments to supervise and if necessary to discharge their functions towards realising clean air and water and atmosphere free from noise and stench. State and Union Governments may also subsidise funds to civic authorities for that purpose.

It may be pertinent to state that not much attention has been bestowed on plans to eradicate pollution in an effective way. The enforcement of programmes are proverbially slow in local bodies. The urgency to tackle the problem of pollution is greater in India than in other parts of the world due to higher growth rate of population here. To meet the higher demands of rising population resort to unplanned cutting down of trees and extensive deforestation of hills and mountains has resulted in ruthless degradation in eco-culture. New production units and modern industry have immensely polluted rivers and natural streams. Atmosphere and water systems are left highly polluted due to emission of poisonous gases, smoke and noise and the discharge of untreated liquids as industrial wastes into the municipal drains and finally into rivers or subterranean wells. This results in causing destruction of both flora and fauna and ultimately results in extinction of animals, birds insects and plant life.

The tanneries, refineries, space centres and nuclear research units and highly specialised industrial undertakings have the potential of large-scale destruction and mass killing of man and beast. What concrete steps are required to be taken to eliminate or lessen the danger to life-supporting elements in the soil and atmosphere? We have to literally race against time to retrieve the lost ground over the years in order to maintain and, if possible, to improve upon the present level of atmospheric purity if we wish to avoid annihilation of human race in this region of the world.

The rural areas are comparatively free from pollutants. In urban centres with population of five lakh or more, or cities having concentration of heavy industry, the municipality must raise revenue to set up a separate department of eco-culture.

manned by a scientist or a technocrat to advise the Chairman or Administrator of the civic body on feasibility of controlling pollution according to the demand of the situation.

The Department of Eco-culture should set up an independent laboratory to monitor and publish in local press daily record of city's pollution index in atmosphere or rivers, lakes and natural streams especially in pisci-culture areas.

The roadside trees must be treated as national property and must be numbered as in the past and unauthorised cutting and lopping of branches should be made a cognizable offence with severe penalties to be imposed on unscrupulous offenders. Apart from a large-scale afforestation, an annual programme for tree plantation (by way of fixing an arbor day) must be organised and responsibility fixed for protecting and watering saplings until they are big enough to survive by themselves. Arrangement for manuring and easy watering would help to ensure sturdy growth of plants. This is the least of municipal duties for a civic body one can suggest for a healthy environment.

Soot and stench from mills and factories should not be allowed to escape in the atmosphere. Unless the industry has the means to reprocess gaseous wastes the license to run the mill must be withheld. Fruit belts or orchards should be protected against the onslaughts by pollutants of brick kilns and petro-oil and other industrial wastes.

Untreated water should be absolutely prohibited to flow down the drains and rivers. Even drainage in underground wells of harmful liquids should be disallowed unless retreated into harmless liquid.

Public lavatories, urinals and electric crematorium facilities should be provided to keep our rivers safe from impurities. Public education is necessary to be imparted through press, television and other audio-visual aids against blatant misuse of public conveniences. Lessons in modesty and sense of shame be given against public exposure of open road-side facilities availed of customarily by people in this country.

Bon-fire on the occasion of religious festivals such as Holi at every road crossing in urban localities by enthusiastic urchins should be socially regulated by voluntary organisations. Heavy denudation is suffered by timber vegetation on such occasions

and cause serious concern to lovers of nature and environmentalists.

Use of loudspeakers to sell wares, lottery tickets and as a mode of public worship must find disapproval of educated public opinion. Noise in factories and mills and transport vehicles should be reduced through city regulations and adoption of latest technology.

The municipal authorities should arrange to provide public gardens and arboreal beauty spots through selective woodlands and ornamental streams and picnic spots to serve the purpose of both beautification and realising ecological needs of the area. This is a traditional function of local bodies for which the civic chief must be personally committed.

Grasslands and grazing plots are an asset to any city. The cattle pens are handy if located near grassland and pastures serve for dairy facilities as well as for environmental aims. It should form part of any city planning to leave open spaces and city wilds for ecological balance and impressive city skyline.

Law alone cannot help in restoring a balance in the biospheric disturbance. Money too cannot always help. It requires intelligent men, men of ideas and imagination and aesthetic values to build and plan cities and maintain them properly. It requires sustained effort through enlightened planning and achieving the goal through effective enforcement of strategies for cleaner environment. Campaigns for general awakening of masses for removal of pollution and dedicated effort to grow more trees and cultivation of love of wild-life and nature is needed in ample measure. 'Environmental Month' is organised by the Union Ministry of Environment and Forests every month in November to popularise the idea of conservation of nature. Seminars and special management studies are a step in that direction and should be encouraged. One cannot be called truly human and civilised unless one has learnt to look upon not only the fellow beings but all creatures with love and affection. With plant vegetation lies the salvation of humanity at large and gives meaning to life as men and women.

Groundwater and Environment

K.P. SINGH*

Abstract

Water, besides being essential to life, is also the most manageable of the natural resources ; it is capable of diversion, transport, storage and recycling. And these properties give to water its great utility for man. In summary, man has improved his living conditions by controlling, developing and using water supplies. Groundwater is an important source of drinking water supply and for irrigation and industrial use. It forms a part of hydrological cycle. Man's use of water alters the hydrological cycle and influences the environment both positively and negatively. The positive effects are encountered daily while negative effects are sometimes less visible until they suddenly appear as environmental problems such as : (a) destruction of water resources through over exploitation (b) deterioration of water resources in quality due to pollution and (c) changes in the total water regime causing water logging and salinization. This Chapter discusses such environmental problems with case histories from India and abroad along with policy guidelines and recommendations.

Introduction

Groundwater represents the largest available source of fresh water available on the earth. The volume of water stored in

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the earth's aquifers is far greater than all the water in lakes, reservoirs and streams throughout the world. Proper development and utilization of this natural resource is of interest for all types of water supply requirements. It is of particular interest in humid areas where precipitation occurs during only limited portions of the year and in arid zones where surface water supplies are extremely limited.

At the present time, there is a marked trend towards a greater development of groundwater sources in India, Japan, Pakistan and several other countries, both for irrigation and for municipal and industrial purposes. India is blessed with a comparatively large resources of groundwater. The total estimate of the present and the ultimate groundwater resources comes to $650 \times 10^9 \text{ m}^3$ and $850 \times 10^9 \text{ m}^3$ respectively.

The underground storage of groundwater has an advantage that is often largely overlooked. Surface water reservoirs must be constructed at great cost, whereas groundwater reservoirs have been created by nature and require little modification for their proper utilization by man. Losses from these underground reservoirs are minimal because evapotranspiration losses do not take place from beneath the earth's surface, except where water tables approach ground surface. Distribution is also largely taken care of because pumping wells can extract water at the point where it is needed in a large valley or groundwater basin. Thus, the cost of pipe line or canal distribution systems is minimized. The large volume of most underground reservoirs constitutes a storage which can be used for a period of many years without causing excessive depletion of the total supply. And, finally, the temperature of groundwater, which is remarkably constant, is an important benefit for industrial and drinking water supplies. This Chapter deals in general with the environmental aspects of this natural resource.

Groundwater and the Hydrologic Cycle

Groundwater constitutes one portion of earth's hydrologic cycle. The permeable formations of the earth serve as transmission and storage conduits for groundwater. Groundwater originates from surface water, the chief sources being precipitation, natural recharge and artificial recharge. Groundwater is

disposed of through surface or subsurface outflow, by extraction, through use by man and by evapotranspiration. For practical purposes all groundwater can be considered to be in motion. The velocities may range from a few feet per day down to as little as a fraction of a foot per year.

Because groundwater is a part of the hydrologic cycle, it should be regarded as a renewable natural resource. Thus conservation is important in developing groundwater supplies and in planning for long-term utilization of basin aquifers. On the other hand, improper development of groundwater results in mining or exhaustion of groundwater supplies so that the continued availability of this resource is reduced.

Man, Groundwater and Environment

Man, by his ability to control and use water has provided a better life for himself through : flood control ; storage for use during dry periods ; dependable and pure domestic and industrial supplies ; increased agricultural production by irrigation ; increased fisheries production ; energy from hydropower ; transportation ; and facilities for recreation.

Man's use of water alters the hydrological cycle and influences the environment both positively and negatively. The positive effects are encountered daily while the negative effects are sometimes less visible until they suddenly appear as environmental problems such as :

- (a) destruction of water resources through over-exploitation resulting into environmental problem of groundwater overdraft ;
- (b) deterioration of water resources in quality due to pollution ; and
- (c) changes in the total water regime causing waterlogging, and salinization.

These deteriorating effects are interrelated and increasing development of water resources is leading to harmful effects on the environment yet the expansion in world population demands intensification of resource use. The environmental problems listed above are discussed below with some case studies :

Environmental Effects of Overdraft of Groundwater

Sustained withdrawal of groundwater at a rate substantially greater than the natural recharge rate produces a number of undesirable side effects upon the environment. Sometimes, these effects are slow in coming, but by the time they are recognized it may be too late to correct the damage. Because the draw-down from a well spreads to the limits of an aquifer, a general lowering of the water table will be felt over a large area after many wells have been in operation for a period of years. For example, in Chandigarh water levels in well fields have been depleting at a rate of 1 m/year since last 10 years. The fall of water levels is responsible for reduction in discharge of tube-wells, drying up of tubewells and wells which have been observed in and around the city. Reduction in the total water supply is main problem especially when groundwater is the only source of water supply.

In other areas harmful effects will be upon ponds, lakes, etc. that normally stand at the level of the surrounding water table. These water bodies can be thought of as surface exposures of water table itself. Thousands of such water-table ponds exist in the southern parts of the country. Although the pond-water levels rise in the spring and decline in late summer and fall, along with the water table itself, if the water table is severely lowered by pumping of groundwater, these water bodies will cease to exist and the eco-systems within them will be destroyed.

Water table decline also affects stream flow adversely. In humid regions the year-around flow of many smaller streams is sustained by groundwater seepage. If the water table falls permanently below the stream level, the stream will contain water only following heavy rain or rapid snow melt. Again as in the case ponds, the eco-system of the permanent stream is destroyed.

In coastal regions, fresh groundwater supplies are vulnerable to contamination by salt water intrusion. Salt water intrusions may be common in South-West portion of Punjab and Haryana States where fresh water lenses occur in saline areas. Overdraft of these fresh water lenses/zones, causes salt water intrusions.

Another serious side effect of excessive ground water withdrawal is that of subsidence of ground surface. The one example

which the author can give is of Bangkok city in Thailand. According to Nutalaya and Rau (1981) the city is sinking at a maximum rate of 10 cm/year in some parts of the city. The author personally observed damaged buildings and streets in Thonburi region of Bangkok because of land subsidence.

Environmental Pollution of Groundwater

Pollution of Groundwater is another serious environmental problem observed by the author in Punjab Plains (Singh, 1978, 1982). Disposal of industrial wastes in the open pools, abandoned dugwells, local depressions have caused the pollution of ground water, for example in Ludhiana area of Punjab State. The industrial effluents infiltrated down into the top phreatic aquifer. The groundwater contains high concentration of toxic elements like Cyanide, Arsenic, lead and chromium. The concentration of these toxic elements is much above the permissible concentration by World Health Organization. The high concentration of these toxic elements has caused serious health hazards in the people taking such waters. According to Ludhiana Municipal Corporation, 109 deaths have been reported and about 1,200 jaundice patients visited the hospitals in the year 1980. In early 1981, between 500 and 600 patients visited the Ludhiana University hospital daily in which 10 per cent of the total number of patients were suffering from stomach ailments. Burning sensation in the throat, vomiting and pain in the stomach has been commonly reported by people using groundwater from areas in the vicinity of industries. There is a need to identify such pollution clouds and to study their travel rate, so that remedial measures can be taken up to check the pollution hazard and protect groundwater resources from contamination etc. Such studies need to be carried out in all the areas close to industrial units.

Pollution of groundwater supplies can take place rapidly in hard rock areas especially in limestone regions where extensive cavern system are below the water table. Movement of groundwater is rapid through large passage ways, so that liquid wastes discharged into sink holes can travel freely to distant points where water is being withdrawn from water-table ponds or supply wells. Detailed studies by groundwater geologists can

reveal the presence of such pollution hazards and are essential in planning for water resource development and waste disposal systems.

Environmental Effects of Engineering Works Upon Groundwater

Major engineering works, including dams, canals and highway cuts in many instances cause significant changes in the water table and the movement of groundwater. These effects can be predicted in advance and should be taken into account in assessing the total environmental impact of a new project. Where a large dam is built and large reservoir of water impounded behind it, water will percolate from the reservoir into the surrounding rocks, raising the water levels in the surrounding region. As a result, adjacent low-lying areas may become saturated wet lands or water-logged with damaging effects upon agricultural land, towns, and highways. One similar example is Faridkot area of Punjab State, where depth to groundwater in some parts is between 1-2 m b.g.l. This high water table has damaged the buildings, roads of the area. Water table has been rising at the rate of 0.5 m year since last decade. The cause of rise of water table being high seepage rate of canal water. Water table started rising since the canal system was introduced and hydrological regime was disturbed. High water table has also caused development of saline/alkaline soils in the area rendering them unfit for agricultural use. This is only one example but there are many more from Western Pakistan and other developing countries.

Related to environmental problems of engineering works is the problem of acid mine drainage, in which groundwater issuing from abandoned coal mines is contaminated with sulphuric acid derived from sulphur compounds in coal.

POLICY GUIDELINES AND RECOMMENDATIONS

The water needed to sustain life can be developed and used with minimum harm to the environment. The solution lies in the correct understanding and treatment of the interrelationship between water development and use and the environment. The

policy guidelines and recommendations at the National level are briefly outlined below:

(a) *Initiate a New Approach to Long-range Planning* which includes the integration of environmental aspects and the promotion of a new attitude to long-range planning. Alternatives needs to be explored and optimum solutions sought, using new methods of evaluation and analysis of the environmental quality. This new concept must be based on the correct understanding of the interrelationship between the development and management of water and the environment as a whole, taking into account the different phases of water occurrence in the atmosphere, on the land, in the soil and underground.

(b) *Control of Water Quality and Quantity* must be decided at the national level for immediate or future development. Water resources should be maintained or improved and allocated for the highest beneficial uses. Basic laws and regulations should be reviewed in this context and, where necessary, should be strengthened.

(c) *Early Warning System* to protect the environment from deterioration must be developed. This can be in the form of water sampling and analysis with computerized determinations of change. It must be carried on with regularity, accuracy and speed so that counteraction can be instigated in time.

(d) *Water Problem Zones* should be defined and immediate action taken to ensure the best distribution of the limited resources. Many areas are faced with the problem of balancing limited resources against ever-increasing needs. Intergovernmental co-operation and action should be initiated for the development of new sources.

(e) *Improved Water Management in Agriculture* is necessary in view of existing heavy demands and projected increases for irrigation. There is a problem of water management at all levels from the source of supply down to the farmer's field. Probably the greatest return would accrue from improved irrigation practices, including training of, and demonstration to, the farmer.

(f) *Educational and research programmes* are urgently required to conserve natural resources for the proper management of the environment. They should be aimed at educating the public and their representatives and training specialists in a

broad interdisciplinary background in environmental problems. National organizations should give assistance in this specific field as well as in training the more highly specialized technical staff required.

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Landuse Monitoring for Effective Management of Environment

P.P. SINGH*

What is Environment

Environment in a layman's understanding implies everything around him, which effects the living of human beings. When we talk of 'living', we do not merely expect survival. In the context of environment, 'living' implies 'living in good health-physical, mental and spiritual. Environment has everything to do with the quality of life. Living also implies to reside, work, relax and move about in reasonable freedom. All the above conditions and activities lead us to a wild thought that environment involves the entire space and spatial activities connected with living of human being. There are very strong interactions among *Human Being*, *Space* and the *Spatial Activities* which entirely decide whether environment is 'acceptable'. Let us take human being as the 'nodal point' then the environment may consists of :—

- His shelter and living Space
- His neighbourhood
- The city
- The surrounding habitation areas
- The space surrounding him, the cities in near vicinity

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- The underground geological conditions in immediate and far vicinity of his shelter

It is difficult to make an exhaustive list of the elements which constitute environment. It depends what basic unit is taken to evaluate its environment. The environment of a human settlement as the unit may involve much macro considerations than the environment of a locality or even each housing unit or the human itself which may involve micro considerations.

In this chapter, an effort has been made to highlight the importance of landuse and monitoring of the landuse changes for an effective management of *Environment*.

2. Each Landuse Change Causes Changes in the Environment

Landuse is the use which the land has been made to. What happens within an urban settlement on the land contributes a lot to the environment. Land has to do a lot in the context of the environment. It is one single element which may generate a lot of environmental problems and may correct plenty. Let us see how the use of it or the change in the use of it makes a substantial effect on the environment, the effective management of the landuse will thus be evidently in significant proportion to the improvement in the environment.

A natural land has a certain degree of balanced environment before exploitation by the human being. The human being who could be termed as the sole agent to start 'activities' on the land basically for its survival and in this process, he forgets, or more precisely 'ignores' what effects his activities make on the environment. He is generally bothered for his economic activity and therefore, does not worry on its effect as otherwise it retards his gains.

His primary activities may be of the type *viz.*, clearing a jungle for his shelter, making fields to grow food, making routes to approach the wooded area to get firewood, to work in his fields or to go to the nearby habitations and so on. A human being, therefore, causes changes in existing landuse during the course of settling down and survival. Thus amount of green areas reduce, pollutants like human wastes, smoke, garbage, etc. start

generating. Improper disposal Pollutes environment. Later when he expands, a locality emanates and the pollution multiplies. Soon a settlement appears. The routes widen, more jungles are cleared, more trees are felled to meet the need of fire wood. Thus more pollutants are produced. Trade and industries develop, thus transportation network appears which starts polluting environment further by gases, noise, etc.

During the building up of a locality lot of earth, stone quarries appear damaging the texture of the land changing the existing landuse, similarly the buildings of the industries.

A vacant land converted to make a bus stand although for the comfort of the people may attract lot of traffic around and may pollute the environment in that locality.

An open ground converted to 'mandi area' although for the convenience of the traders, consumers spoils the environment due to generation of lot of traffic, collection of lot of garbage, flies, mosquitos, etc.

A patch of land converted to a pond to improve the locality environment may turn out to be a sticking pond due to mismanagement.

A patch of barren land changed to a green land will improve the environment, similarly the planting of trees.

From the foregoing examples one conclusion emerges viz., "*Change in Landuse Changes the Environment.*"

An effective *Monitoring of Landuse*, therefore, will contribute substantially to the effective management of the environment. An upto date periodic records of landuse of an area can help predict the good or ill effects of proposed landuse on the environment. So careful decisions taken based on such a scientific data is likely to render favourable environment.

The Affordable Technique

Using 35 mm photography to monitor landuse and the changes in landuse.

A large number of urban data, landuse data and the environmental data does not require such a fine accuracy as the topo map. Resorting to costly conventional aerial photography is beyond affordable limits for such insignificant project and therefore, demands the employment of cheaper techniques.

One such techniques is using 35 mm camera and light plane for the purpose. The technique employs light planes like cessna, piper, pushpak, microlight, etc. and 35mm camera. Hobby Pilots from local flying club will be too glad to fly for you and add to their flying hours with no extra cost than the fuel cost only. Flying as low as 300 m above the ground can picture object as small as parking meters, road markings, traffic lights, etc. leaving aside changes in landuse and many micro environmental data.

Supplementing Rather than Replacing Conventional Aerial Photography

This 35 mm Photography although have low metric quality can be very effectively utilised to get sequential pictures for monitoring purposes with little investments.

Some Applications in Environment Context

- Detection of garbage dumps, inventory of dustbins, siting of disposal sites
- Inventory of open spaces within congested areas for development with a view to improve environmental condition
- Inventory of deforested areas, and monitoring of depletion of forests and plantations
- Inventory of industries emitting smoke, effluent and other open air storage of hazardous material
- Detection of ill maintained parks, areas suitable for landscaping
- Inventory of trees in the city and finalising location for fresh plantation and its monitoring
- Detection of spots of stagnant water, open drains, areas lacking pools, roads without trees
- Inventory of landuses and changes from sequential Photography
- Other uses in urban data collection which have indirect environmental significance

Conclusion

It is evident that *Planning of Landuses* keeping in view the good habitability will ensure a quality *Environment* and there-

fore, the functions of the following group becomes very important :

Urban Surveyor : Who ensures prompt availability of the updated and accurate data timely for sound and factual planning in correct form and format and help in monitoring the same.

Urban Planner : To plan the city and its environ (region) to ensure its good habitability.

Urban Administrator : To ensure maintenance of thus created city.

If a human settlement has been planned based on all factual and relevant data and maintained well, we have achieved the large part of the *Environmental Management*. The use of latest techniques will help to achieve the results accurately, cheaply and timely

Problem of Environmental Pollution and its Management in India

G.S. BAJWA*

The problem of environmental management is becoming a matter of great concern not only in India but all over the world. The increasing population, industrialisation and urbanization have resulted in acute environmental problems. The ecological danger is no less serious than some of the others to which urgent attention is now being paid in most part of the world. The precious gifts of Nature are being destroyed and human life is being shortened by the polluted air we breathe and the unhealthy water we drink. The welfare and existence of human race is dependent upon the proper inter-action of man and his environment.

The environment refers to natural things around us which sustain human life, such as the earth's atmosphere or healthy air or drinkable water. The environment may be defined as that outer physical and biological system in which man and other organisms live with many interacting components. The usually identified components of the environment include "its rocks, minerals, soils and waters, its land and their present and potential vegetation, its animal life and potential for livestock husbandary, and its climate."¹ There is said to be a close interaction among these various components which seem to produce some kind of an equilibrium in the scheme of nature what is usually termed as 'ecological balance.' This system is useful to man. Perfect ecological balance cannot be expected

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in the wake of growing industrialisation and modernisation. So, pollution of environment is inevitable.

The environment has "carrying capacity", or the amount of pollution or damage an environment can sustain without further degradation. A lake that is 5 times larger than another one can carry roughly 5 times the pollution load. If the loads of pollution are not minimised or environment upgraded to an extent that it will be able to carry them, the environmental degradation will inevitably worsen. By the mis-use, abuse and uncontrolled use of resources both natural and otherwise have upset the equilibrium between human activity and nature. The progress and welfare of mankind are at stake. The present generation as well as posterity has to be protected against this subtle hazard of unknown dimensions. In this Chapter an effort has been made to analyse the measures adopted by India to control water and air pollution which form major components of environment.

Water Pollution

The control of water pollution is a world-wide movement. Water is called 'Jiwan' in Sanskrit. It is life itself. One cannot use stronger words to indicate the importance of pollution free water. According to Central Board for the Prevention and Control of Water Pollution :

The fresh water that is so essential to our lives is only a small portion of the earth's total water supply; it is only about two per cent of the total. Nearly all of this, however, is locked in the masses of ice-caps, glaciers and clouds; and constitute about 1.998 per cent of the total. The remaining small fraction of fresh water has accumulated over centuries in the lakes and underground supplies of the world.

Almost 85 per cent of the rain falls directly into the sea and never reaches the land. The small remainder precipitates on land. It is this water that fills the lakes, wells, underground supplies, and keeps the river flowing and the latter constitutes only 0.00008 per cent of the total. Humanity is left with only one tea-spoon full of sweet water for every five litres of total water.²

Water is thus a scarce-commodity, and it is getting scarcer everyday as communities, industries and agriculturists discharge their filth, muck and harmful wastes into the nearest sink.

(a) Sources of Water Pollution

In India, there are many sources of water pollution. Firstly, community wastes for human settlements give rise to water pollution. Contrary to the common belief, it has been estimated that the community wastes "account for four times as much waste water as industrial effluents." Most of these wastes are discharged untreated into the water courses. Secondly, industrial effluent directly entering into a stream or through a municipal sewer or through a discharge on land meant for irrigation causes water pollution. In Madhya Pradesh, the Kurel river was polluted due to organic and inorganic effluent discharged by some industries. Even after treatment, the water was not fit for human consumption.³ Thirdly, anything stored on earth, such as, any raw material, solid refuse of a mine or quarry on any land may cause pollution by rain washing it into a stream. It happened in Goa where molasses stored in open pits in a cooperative sugar factory at Usgaon in Goa was washed by rain into the Khandapar river. This resulted into degradation of the quality of water and even after filtration it could not be used for human consumption. A large number of fish was also killed due to water pollution.⁴ Fourthly, the use of fertilizers also causes water pollution when unused nitrogenous fertiliser is drained out of soil into lakes and rivers. It causes overgrowth of green plants resulting in pollution of water. The use of pesticides for agriculture may cause pollution due to rain water washing it into stream. Fifthly, water pollution may also be caused by air pollutant. Recent reports from Western countries indicate that by far the largest contribution of heavy metal pollution in lakes (*i.e.*, from cadmium, mercury, lead, etc.) comes from air-borne pollutants mainly from coal combustion—settling on lakes and their catchment areas. Comparatively negligible contribution is received from direct industrial effluent discharges.⁵

Even ground water is not free from pollution. It is being polluted due to dump trade or sewage effluent into underground

strata. But ground water may be polluted due to seepage or percolation from the surface. Human wastes may cause pollution by seepage from improperly constructed or improperly placed septic tanks, or leaking sewer lines. Industrial wastes, including highly poisonous chemicals, may be introduced to the ground water either by intention or accident. Even the dumping and covering of vegetable materials in garbage result in their decomposition and the carrying down of decomposition products, including carbon dioxide gas, by percolating water into underlying ground-water bodies from the article.⁶

(b) Legal Regulation of Water Pollution

The United Nations has repeatedly expressed deep anxiety over the ceaseless pollution all over the world and the innumerable problems it creates. Under the auspices of the United Nations, a conference on the Human Environment was held at Stockholm in June 1972 which laid down the principles and action-plan for controlling and regulating human environment and institutional and financial arrangements for that purpose. The General Assembly of the U.N. also passed a resolution on 15th December 1972 emphasising co-operation between the States in the field of conservation of human environment, June 5th is designated as the World Environment Day and the U.N. urges the member States to undertake on that date every year world wide activities reaffirming their concern for the preservation and the enhancement of the environment.

India is one of the few countries of the world that have made specific reference in the Constitution to the need for environmental protection and improvement. Within five years of this Conference the Constitution of India was amended. Now under the Indian Constitution, it is one of the fundamental duties of the State "to protect and improve environment and to safeguard the forests and wild life of the country."⁷ Besides the State's obligation towards the society at large, the individual members of the society themselves also owe a fundamental duty "to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creature."⁸ Therefore, constitutionally man is required,

in the process of prosecution of his purposes, to protect and improve the natural environment.

The most comprehensive legislation in India for the prevention and control of water pollution are the following :

- (i) The Water (Prevention and Control of Pollution) Act, 1974.⁹
- (ii) The Water (Prevention and Control of Pollution) Amendment Act, 1978.¹⁰
- (iii) The Water (Prevention and Control of Pollution) Cess Act, 1977.¹¹
- (iv) The Air (Prevention and Control of Pollution) Act, 1981.¹²
- (v) The Environment Protection Act, 1986.

The Water (Prevention and Control of Pollution) Act, 1974 was passed (amended in 1978) with the following objects :

- (i) To provide for the prevention and control of water pollution and maintaining or restoring of wholesomeness of water (in the streams or wells or sewer or on land);
- (ii) to establish Central and State Boards with a view to carrying out the above purposes;
- (iii) for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

To achieve these objectives Act requires that no person shall knowingly cause or permit any poisonous, noxious or polluting matter determined in accordance with such standards as may be laid down by a board to enter (whether directly or indirectly) in any stream or well.¹³ Further, it imposes a prohibition on a person to discharge sewage or trade effluent into a stream without consent of the Board.¹⁴

For the contravention of the standards laid down by the State Board and for violation of the provisions relating to the consent by the Board, stiff penalties have been provided. Penalty, on conviction will be imprisonment for a term which may extend to three months or with fine which may extend to five thousand rupees or with both. In the case of continuing

failure the Act provides for a penalty of an additional fine which may extend to one thousand rupees for every day during which such failure continues after the conviction for the first such failure. Penalty for contravention of the provisions of Sec. 24 shall not be less than six months but it may extend to six years and fine.¹⁵ When a person commits an offence for which he had been convicted earlier the court can publish his name and all other details in newspapers. The costs of such publication should be met by such person.

As far as discharge of sewage or trade effluent on land is concerned, the 1978 amendment of the Act requires consent orders of the Board. But there is nothing in the Act with regard to storage on land. At the time of licensing of industries by the Central Government under the Industries (Development and Regulation) Act, 1951, the concerned unit could be asked to obtain clearance from the point of view of pollution also. The Act empowers the Boards to advise the State Governments with respect to location of any industry the carrying of which is likely to pollute a stream or well.¹⁶

It has been stated above that even air pollution may cause water pollution. To deal with pollution of air, now we have, Air (Prevention and Control of Pollution) Act, 1981. The task of controlling air pollution is entrusted to the Water Pollution Boards under the Act. It is expected that the Water Boards acting under the air pollution statute will take suitable measures to control air pollution which may lead to water pollution.

It is to be noted that this Act is not free from drawbacks. This Act does not define important and relevant terms like 'Pollutant', 'discharge of pollutant', 'Toxic pollutant', etc. In the definition of pollution, "radiological" integrity of water is not taken into account. Offences are not specifically defined and the punishment prescribed are not applicable for all possible violations. The degree of culpability is given in such a manner that it would be difficult to prove the allegations. Punishment is provided only if the violation is with knowledge. Punishment has not been provided for negligent acts. The fines prescribed are comparatively small.

Air Pollution

The major component of the biosphere is air without which no life can survive (except some lower forms of Bacteria). Without air of good quality there cannot be a healthy life. Yet clean air is a rare commodity today, especially in our big cities and towns. Air pollution is as old as industrialisation. Pollution of the air differs in some aspect from pollution of water. Discharge from industrial premises to the atmosphere are often more or less continuous during working hours and they can drift high or low and in any direction, depending on the wind and weather. Pollution of the air is more wide-spread in its effect than other forms of pollution for people who have to breathe the air. If water is polluted one can avoid drinking it, or may drink it after purification. But one cannot avoid breathing polluted air ; one has to take it as it comes.¹⁷ Polluted air contains solid and liquid particles such as dust carbon, hydrocarbons, etc. which are electrically charged and thus kept in suspension by electrostatic forces. It may also contain gases which are poisonous or abnoxious in nature—sulphur dioxide, carbon monoxide, oxides of nitrogen, hydrocarbon vapours and other substances. The most harmful element is benzopyrene.

(a) Sources of Air Pollution

Firstly, air pollution may arise due to basic needs of individuals which includes domestic fire and domestic incineration which is required for cooking and heating. It is a weak and inevitable source of air pollution. Secondly, air pollution is caused by vehicles such as road vehicles, air crafts, ships, railways and other combustion engines. With constantly increase in transportation in towns and cities with hot climate, the problem of air pollution is assuming greater importance. No doubt the number of motor vehicles in Indian cities is far less than in cities in the West, the pollution level is almost the same. This is mainly due to lack of maintenance of Indian cars and the absence of any effective deterrent to plying such cars on city roads.¹⁸ Thirdly, industry is the principal source of air pollution and it covers all types of units which consume energy in any form. It includes coal, oil, natural gas, electricity or

nuclear fission. Dark smoke emitted by industries pollute the air in large scale. Thermal power plants many of which are located right in the heart of the major cities pollute air substantially. Thermal power plants in India are entirely coal fired and although the coal used in these plants is low in sulphur, it has a high ash content—often upto 40 per cent. So pollution from these plants comes mainly as fly ash although sulphur dioxide emission is also substantial.¹⁹ Fly ash is not only a nuisance as it covers everything with a coat of dirty gray, it is also a major health hazard. Prolonged exposure to fly ash is known to cause respiratory disease including tuberculosis.

It is to be noted that air pollution adversely affects the health of human beings as well as ecology. It is reality that people living in polluted areas are suffering from certain diseases (*i.e.*, Bronchitis, Myocerdial Pneumonia, Coronary, Lung Cancer, Vascular lesions of the nervous system, etc.) then the people living in fresh air.

(b) Legal Regulation of Air Pollution

To control air pollution, Indian Government has passed The Air (Prevention and Control of Pollution) Act, 1981. This Act under Section 2 defines air pollution as the presence of any solid, liquid or gaseous substances present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. Pollution damages not only the health of the individuals, it rather affects adversely the entire social fibre and leaves it unbridgeable impacts. Act provides for separate Central and State Boards for the prevention and control of air pollution but at present this authority has been granted to the Central and State Water Pollution Prevention Board. As in the case of water pollution the public affected by air pollution cannot approach the courts without obtaining prior permission from the Board. This discourages people from participating in the execution of the National policy.

Section 21 (1) of the Air Pollution Act says that no person shall, without the previous consent of the State Board, operate any industrial plant specified in the Schedule in an air pollu-

tion control area. The schedule has a list of 20 types of industries.

Section 20 of the Air (Prevention and Control of Pollution) Act, 1981 prescribes standards for emission of polluted air from automobiles. Accordingly, the State Governments are empowered to give such instructions as may be deemed necessary to the concerned authority incharge of registration of motor vehicles under the Motor Vehicles Act, 1939.

New Measures for Environmental Management

Realising the inadequacy of existing legislation regulating the environmental pollution, the Government of India recently sponsored a Bill for this purpose. The new Environmental (Protection) Act, 1986, is far better in approach than the earlier laws. The aim of new measure is to provide for the protection and improvement of environment and for matters connected therewith. The Act contains provisions for tackling the inter-relationship between nature and human beings and the diverse kinds of pollutants. It empowers the Central Government to make rules for the maximum allowable limits of concentration of various environmental pollutants (including noise) for different areas.²⁰ This Act defines hazardous substance as 'any substance or preparation which, by reason of its chemical or physio-chemical properties or handling, is liable to cause harm to human beings, other-living creatures, plants, micro-organisms, property or environment.'²¹

There are stringent measures to check hazardous pollution. Section 8 of the Act states clearly that "No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed." Section 6 (f) empowers the Central Government to make rules for "the procedure and safeguard for the prevention of accidents which may cause environmental pollution and for providing remedial measures for such accidents." Moreover, it is now mandatory for a person responsible for the discharge of any hazardous substance in excess of the prescribed norms to immediately inform the concerned authorities and to render all possible assistance.

Vigilant citizens can initiate proceeding against an establish-

ment that is polluting the water supply or otherwise running the environment. The penalties for defaulters have been made more stringent. The Water Act provided for a maximum imprisonment of six years and/or a fine upto a total of Rs. 5,000 ; in the Air Act the limits were a maximum imprisonment upto three months and/or fine upto a total of Rs. 5,000. The new Act provides for imprisonment of defaulters for upto a total of seven years and/or fine which may extend upto Rs. one lakh.²²

However, the new Act is not free from flaws. There is no provision relating to forests, even though it is known fact that in India about 50 per cent of the energy consumed is non-commercial or collected from fields, trees and bushes. Legislation in respect of enhanced penalties and for tightening the enforcement of the provisions has yet to be brought up. It is also not clear whether the new Act supersedes or supplements the two earlier laws. The enhanced punishment may or may not be deemed applicable to cases which fall under the purview of the other Acts. The areas of jurisdiction have not been clearly demarcated. Further, there is no clear provision for public participation which is vital for preserving the environment. The relevant issues are left to official bodies (Air and Water Pollution Control Boards) and other regulatory agencies. Any individual can file a complaint with the Government against a factory management, but it requires the complainant to give 60 days notice, which permits the offending management to bring its emissions within control.²³

Apart from legislative measures, Indian Government has also formulated a plan to clear polluted rivers and to make their water worthy of consumption. India has launched a Rs. 292 crore project to clean up the mighty Ganga, which has been greatly polluted as a result of the inflow of effluents and dirt from various sources. There are about 100 cities situated along the banks of the river, in the State of U.P., Bihar and Bengal. About 4200 small and medium units are responsible for polluting the holy river. The cleaning up work began at Rishikesh and Haridwar in September 1985. It is also in progress at Varanasi.

Recently, the Central Government has decided to set up a cell to ensure effective implementation of anti-pollution measures.

It has been decided to enforce strictly provisions of Environmental Protection Act, 1986 and Forest Conservation Act, 1980. The Government has decided to give a maximum of two years period of installing treatment plants during the next two years. All industrial units both in the public and private sectors and Thermal plants would have to observe strict discipline for protecting the environment and treating effluents. Out of the 84 major cement factories in the country, work of setting up treatment plants for 14 public sector factories had already completed. In the case of private sector reasonable progress has been made. In future all big units would have to seek Environment Ministry's clearance certificate before going into production. To ensure better environment, efforts were being made to check the emission of smoke by buses, trucks and three-wheelers. For the first time, 200 battery-operated buses were being run in Delhi on an experimental basis.²⁴

Conclusion

Our mad race for economic development through industrialisation at the cost of environment would ultimately lead to disaster. If the present rate of pollution is not checked, the man will see, eat and breathe pollution. So the solution lies in harmonising of economic development with environment. The Government of India and several State Governments have in recent years become increasingly conscious of the growing environmental crisis and have enacted new laws and revised outdated ones. The Government of India has formed a new 'Department of Environment' in November 1980 which is followed by in a few States also. Special attention is being paid to environment in Five-Year Plans. No doubt, efforts of the Central Government to protect environment is encouraging but still we are unable to control the menace of environmental pollution substantially. So, the problem of environmental degradation is a complex one of which there can be no single solution. Any viable strategy must take into account not only the physical nature of the problems but also human factors involved. For conservation and upgradation of environment following are useful suggestions :

- (a) The increasing population makes excessive demands of environmental utilization which results in its degradation. The challenge before environmentalists and policy makers should be to protect environment from human depreciation. This will be effective only if it is linked to population growth control. It is important in this regard to reduce the rate of population growth to one per cent from the present 2.2 per cent.
- (b) It is being realised that the enactment of a code is not the ultimate solution to this multi-dimensional problem of environmental management but much depends upon those who are entrusted with the task of implementing the provisions of such legislation. Government should take such negligent officials to task who do not perform their duties to protect environment. There is no dearth of environmental laws but we need firm hand to implement it.
- (c) There is acute shortage of properly trained manpower in the subject and the areas related to environmental administration, poor implementing and monitoring machinery are causes of its failure. It is the environmental field which necessitates proper training to the persons dealing with environmental problems. Environment should not be regarded as just another sector of development. It should form a crucial guiding dimension in each department and ministry.
- (d) The environmental problem has to be viewed collectively by all, because the environment as such affects. The very existence of human beings on this planet which is one for all without any division of any form. The effort of the State must be supplemented by the efforts of the individuals and other agencies. To check environmental pollution, it is necessary to raise public opinion against this dreadful problem. Environmental education can contribute much in this direction. For mobilizing people to undertake constructive programmes aimed at environmental conservation, voluntary agencies and non-Governmental organisations can play an important role. To ensure full implementation and effective enforcement of the pollution control laws, it is essential

to impart meaningful and worthwhile education of the subject so as to train a cadre of personnel fully aware of the dynamics of law in this area.

- (e) Case studies and empirical research projects shall be launched with the help of modern technology, methodology and applied science so as to evolve new methods of environmental protection.
- (f) Regulations, rules and prescribed standards should be suitable to the changing conditions in the society with growing urbanisation and industrialisation so as not to hamper the national progress.
- (g) Separate courts or Tribunals should be established for trying cases connected with environmental pollution.
- (h) The recognition of public interest litigation in the conservation and improvement of environment should be encouraged by the courts. It is for the courts to recognise that representatives of the community whether an individual or an association have as good a right as anyone else to come to the courts for relief to prevent an injury to public interest or to protect and improve public property or environment.
- (i) Industrial and town planning should be given due importance. The pollution can be controlled to some extent by proper industrial town planning, *i.e.*, by locating new industries in such a way that residential areas are not affected by it. Centralizing the identical industries at one place, if possible, a single treatment plant can be installed to check pollution.
- (j) Research should be encouraged to devise processes which are less expensive but efficient for recycling of the industrial wastes so as to use them as by-product or raw material for sister industry and develop their secondary uses.

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8. Article 51A(g), inserted by Section 11 of the Constitution (Forty-second Amendment) Act, 1976. The new Part IV-A of the Constitution entitled as "Fundamental Duties", (consisting of only one Article) was inserted by the 42nd Amendment.
9. Act No. 6 of 1974. It was applied in the first instance, to the whole of the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal and in the Union Territories. In other States the Act would be applicable as and when it is adopted by resolution under Clause (i) of Article 252.
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12. Act No. 4 of 1981.
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14. Section 25 and 26 of the Water (Prevention and Control Pollution) Act, 1974.
15. Section 41 of the Water (Prevention and Control of Pollution) Act, 1974.
16. Section 17(n) of the Water (Prevention and Control of Pollution) Act, 1974.
17. Biman Basu, "Environment Protection : A many-faceted problem," *Current Topics*, Ambala Cantt, July 1986, p. 474.
18. According to specifications prescribed by the Indian Standards Institution, vehicles powered by spark ignition engine should not emit carbon monoxide exceeding 3 per cent by volume of exhaust gases, and vehicles which are more than 5 years old should not emit carbon monoxide more than 4.5 per cent by volume. But tests conducted by the Central Board for the Prevention and Control of Water Pollution (which also takes care of air pollution) in Delhi have shown that only about 38 per cent of the two-wheelers, 53 per cent of the three-wheelers and 24 per cent of the four-wheelers met these requirements. The rest emitted for higher amounts of carbon monoxide. See, Biman Basu, "Environment Protection : A many-faceted problem", *Current Topics*, Ambala Cantt, July 1986, p. 474.
19. For instance, the two major power stations in Delhi together produce about 175 tonnes of fly ash and give off 70 tonnes of sulphur dioxide every day. Even electrostatic precipitators are unable to cope with such higher volume of fly ash and a substantial

- amount is let out into the atmosphere. See, Biman Basu, "Environment Protection A many-faceted problem", Current Topics, Ambala Cantt, July 1986, p. 474.
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Constitutional Imperatives for the Control of Environmental Pollution

BALRAM K. GUPTA*

This is to say the least : we must understand that the atmosphere cannot be used as a garbage can by the State or by the individual. And yet there is every kind of pollution prevalent. Land, water and air nothing remains spared. The problem of environmental pollution is like the pollution problem. It is ever increasing. It is a problem of the developed, the developing and the under-developed countries. It seems no one is free from it. Therefore, it deserves a serious consideration.

The Constitution of India of 1950 did not make any specific provision to deal with environmental pollution. Indirectly, one could locate it in Article 47 which reads :

The State shall regard the raising of the level of nutrition and the standard of living of its people and *improvement of public health* as among its primary duties

For the improvement of public health, it is necessary that the State should be able to provide pollution-free environment. It was in the year 1976 that it was thought necessary to make a direct provision for 'The Protection of Environment' in the Constitution. This was done by the 42nd Amendment in 1976. Article 48-A was added :

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The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country.

Side by side, the same Amendment added a Fundamental Duty to be observed by every citizen in Article 51A (g) :

To protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.

Thus the Constitution makes two-fold provisions. On the one hand, it gives directive to the State for the protection and improvement of environment and on the other, it casts a duty on every citizen to help in the preservation of natural environment. The Constitutional recipe for the control of environment is good. If the State and the citizens perform their respective Constitutional duties, it is submitted that the problem can be controlled largely, if not wholly. But it equally needs to be realised that the laws (including the Constitutional law) do not possess self-propelling mechanism. If laws are not put into action, they remain dormant and bring justice to none. Even the fundamental law remains dead letter, if there is no machinery to put the law into motion.¹

Judiciary can play vital role in the growth and development of Constitutional Law. If any evidence of this is needed, the role played by the Indian Supreme Court in the post-internal emergency era (1977 onwards) is a living testimony of it. The Judiciary helps in providing the flesh to the bare skeleton of the Constitution. It gives meaning to the provisions of the Constitution so that the Constitution does not merely remain a paper formality. The Constitution is interpreted in the background of its general philosophy. It is deemed to be one wholesome document and not that it is given piece-meal interpretational treatment.

There is a large body of laws dealing directly or indirectly with the control of environmental pollution. According to one estimate, there are 350 pieces of legislation relating to environmental safety.² There are also numerous official bodies to deal with environmental problems. There is a separate Department

of Environment of the Government of India. This was set up in 1980. Taken together, this all reflects the concern of the Government about the growing menace of environmental pollution. And yet this concern has not been able to bring in some tangible results. This obviously means that the laws concerning pollution are not being effectively implemented as also no serious view is being taken for the violation of these laws. In turn it means that the people will have to show more concern about their environment and, therefore, for their rights and the Courts will have to come to their help. Without this two-fold concern, it does not seem possible to achieve any positive results.

The Supreme Court has already set the path. Its judgment in *Ratlam Municipality*³ case of the year 1980 is so far reaching consequence. The issue in question was of public importance. Residents of a locality within limits of Ratlam Municipality were tormented by the stink caused by open drains and public excretion by nearby slum-dwellers. They moved the Magistrate under section 133 of Cr.P.C. to require the Municipality to do its duty (under Section 123 of the Municipalities Act) towards the members of the public by removing the existing nuisance. The municipality expressed its financial inability to carryout its duties under Section 123. Therefore, the question before the Supreme Court was that will the financial inability validly exonerate the Municipality from its statutory liability to carry out certain public duties? Justice V.R. Krishna Iyer speaking for the Court held :

The Criminal Procedure Code operates against statutory bodies and others regardless of the cash in their coffers, even as human rights under Part III of the Constitution have to be respected by the State regardless of budgetary provisions. Likewise Section 123 of the Act has no saving clause when the municipal council is penniless.⁴

The justification for this view is obvious. Otherwise, the Municipality may legally defy duties under the law by urging in self-defence a self created bankruptcy or perverted expenditure budget.⁵ In fact, it would become a stock 'alibi' for every statutory non-performance. The Court made it clear that the

directives given by the Magistrate under Section 133 of Cr.P.C. if not complied with will attract S. 188, I.P.C. for the award of punishment to the Municipal Commissioner or other executive authority bound by the order.⁶

The Court in this case was visibly moved by the goal of the Constitution—social justice. The case highlights the concern of the court that it must intervene to provide justice to the needy people when they are made to suffer polluted environment. It records :

Public nuisance, because of pollutants being discharged by big factories to the detriment of the poorer sections, is a challenge to the social justice component of the rule of law.⁷

This case should shake every Municipality in the country from its 'hands off' attitude. No Municipality can any more plead inability of resources. Rather, on the other hand, Municipalities should come forward of their own with plans and positive steps towards providing cleaner environment.

This case is also an authority for what is called : Access of justice. It says :

If the centre of gravity of Justice is to shift, as the Preamble to the Constitution mandates, from the traditional individualism of *locus standi* to the community orientation of public interest litigation, these issues must be considered. In that sense, the case before us between the Ratlam Municipality and the citizens of a ward, is a path-finder in the field of people's involvement in the justicing process.⁸

Allowing the jurisdiction to the people, the Court held :

Social Justice is due to the people and, therefore, the people must be able to trigger off the jurisdiction vested for their benefit in any public functionary . . . In the exercise of such power, the judiciary must be informed by the broader principle of *access of Justice* necessitated by the conditions of developing countries and obligated by Article 38 of the Constitution.⁹

This shift from individual to community *locus standi* resulting in Public Interest Litigation is a very welcome step in the *Access to Justice* Jurisprudence. Earlier to this, it was necessary for the individual to establish the violation of his right. Now even if there is no violation of a right of an individual as such but the interest of a large number of persons as a group is being threatened, the group gets the *locus to focus* the right before the Court. The new interpretation given extends the accessibility of justice to a large number of persons *at the same time*. Therefore, from individuals to groups, Justice is made available. It has double benefit. It reduces the work of the court and makes justice more-broad-based. This approach will be very useful in the area of environmental pollution.

Environmental pollution is not the problem of individuals. It is the problem of the community. It is the problem of the people living in a particular environment. This Supreme Court remedy in the form of Public Interest Litigation¹⁰ is most suitable for combating the malady of environmental pollution. It is so because those who live in polluted environment are generally illiterate, poor and not knowing their rights under the Constitution or under other various laws. They, therefore, keep on suffering their surroundings. The laws and the various authorities remain silent because they get active only when they are order to get into motion. In the changed remedial pattern now, those persons and social groups to whom the cause of the poor is dear can come forward. The poor will have the solace that they have some groups who speak for them and fight for their cause. The courts will no more be silent spectators. They will be active participants in the social drama of the country by entertaining their petitions and granting relief in appropriate situations.

Do the people of India have a fundamental right to live in unpolluted environment? Is it not deducible from Article 21? What are the rights to life and personal liberty? Right to life has been interpreted to mean not mere animal existence.¹¹ If pollution causes permanent disabilities leading to mal-functioning or non-functioning of vital organs of the body, will it not be mere reducing him to animal existence and thereby denying him the right to life? What is personal liberty? Is it

not my right to personal liberty to life in pollution free environment? If the State fails to ensure reasonable environment, it would amount to the violation of right to personal liberty. It is submitted that a two-fold remedy will be necessary in this context :

- (a) In view of the violation of Article 21, it would be reasonable on the part of the Court to give positive directions to the State authorities under Articles 32 and 226 to adopt schemes for the prevention of pollution and thereby prevent the continuation of such environment. Giving of directions by the Courts will be very much within the ambit of Articles 32 and 226.
- (b) Secondly, the courts should grant damages for the violation of fundamental rights to life and personal liberty. As long as the courts will not come forward with this affirmative action,¹² the State authorities will not take the matter with necessary seriousness. Even otherwise, when the citizens have suffered physically and mentally because of the negligence on the part of the State authorities, they must be duly compensated. If the State fails to enforce its laws as a result of which citizens are made to suffer polluted environment, the blame is entirely on the State. Therefore, it ought not to be allowed to take advantage of its own wrong. Judicial process does not only mean adjudication. It also includes affirmative action.

The citizens also owe a Constitutional duty to protect and improve natural environment. In this context, wherever it is found that the citizen is violating any laws meant for the protection of environment, he must be seriously dealt with. Whether it is the State or the citizen, no one is to be spared. Two fold attack will have to be mounted.

Conclusions

- (a) Courts need to encourage Public Interest Litigation to deal with the problem of environmental pollution.

- (b) Article 21 be liberally interpreted in order to include the right to unpolluted environment.
- (c) The Courts should grant damages for the violation of the right to life and personal liberty on account of environmental pollution.
- (d) Citizens violating environmental laws must be given severe punishment under the law.

Probably, no other Constitution makes specific provisions in regard to environmental pollution. The Constitution of India has given the lead. It is hoped that with the backing of the Supreme Court and High Courts, the Constitutional imperatives will become meaningful in controlling environmental pollution. The trinity of State must make full effort to ensure cleaner environment. The legislature by enacting the laws, the executive by effective implementation of them and the judiciary by acting as a vigilant and meaningful watchman of both the legislature and the executive. At the same time, the citizenary must realise that the surroundings belong to them and that they must keep them neat and clean. This all can go a long way towards healthier and better environment.

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11. *A.K. Gopalan v. State of Madras*, AIR 1950 SC 27 ; *Khark Singh v.*

State of U.P., AIR 1963 SC 1963 ; *Munn v. People of Illinios*, 94 US 113.

12. Ignoring the traditional path, the Supreme Court laid down 'affirmative action' theory in *State of Kerala v. T.P. Roshana*, AIR 1979 SC 765. In the affirmative theory, the Court does not merely stop at striking the illegal act. It further grants relief by passing an affirmative order to be carried out by the competent authority.

Environmental Protection—A Constitutional Obligation

V.K. BANSAL* AND N.K. GUPTA**

Introduction

Pollution is the result of modern industrialization and urbanization. Rich and literate raise cry against pollution, though some time they are themselves responsible for it. The poor and slum dwellers remain dumb about it. They live in polluted atmosphere, unpolluted by the slogan of environmental protection, whether in big cities or towns or in small villages. They know neither the laws nor the campaign against the environmental pollution ; they know neither their fundamental human right, nor fundamental duty, of own or of others, to have unpolluted environment. They only deem it a privilege to live in the polluted atmosphere. Ponds of dirty water particularly in rainy season, heaps of dirt, unbuilt roads raising dust on walking, open drain manholes, cowdung heaps and public excretion by humans for want of public lavatories, dark streets at night, deafening noise, nallah and drains carrying industrial discharge, air suffocating with smoke or industrial gases, etc., are essential part of surrounding environment for them. Lack of sense of importance of environmental protection, ignorance of procedural remedial mechanism, illiteracy—general and legal—and poverty strengthen the belief of satisfaction in *status quo*.

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These may appear to be social and economic issues but they also involve problems of access to justice for them, which are individualistic as well as community oriented. Various legislative and administrative measures adopted by government show its serious concern for protecting environment. Judicial activism provided impetus to the campaign against pollution. Vardhichand showed the path for people's involvement in justicing process, sans which the system would crumble under the burden of its insensitivity.¹ Judicial activism is the hope but, just as to get the butter, churning is essential, similarly, its vibrational impact would not be possible so long as 'no-action' status continues due to ignorance of procedural remedial measures.

INTERNATIONAL CAMPAIGN

Stockholm Declaration, adopted by the International Conference on Human Environment in 1972 to which India was a party is called the *Magna Carta* of our environment.² It declares :³

- (a) Man has the fundamental right to freedom, equality and adequate conditions of life, *in an environment of quality*⁴ that permits a life of dignity and wellbeing ; and
- (b) Man bears a solemn *responsibility to protect and improve the environment for present and future generation*.⁵

The declaration further directed that the natural resources must be safeguarded for benefit of present and future generations through careful planning or management ;⁶ the heritage of wild life and its habitat should be safeguarded ;⁷ economic system should be protected and struggle against pollution should be supported ;⁸ pollution of sea should be prevented.⁹ The declaration recognised that economic and social development is essential for ensuring a favourable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.¹⁰ Economic factors and ecological processes have to be taken in account for environmental management. The States should adopt an integrated and co-ordinated approach to their

development planning so that there is no conflict between the needs of development and the need to protect human environment.¹¹

The declaration recommended that *education in environmental matters is essential* to broaden the basis for an enlightened opinion and responsible conduct by individuals and communities in protecting and improving environment in its full human dimensions. Mass media should help in this.¹² There should be international efforts and co-operation to protect and improve environment.

Viewed from any direction, the Stockholm Declaration was an important milestone for the international environmental movement.¹³

Final Act of the Conference on security and co-operation in Europe, on 1st August, 1975 affirmed that the protection and improvement of the environment in the interest of present and future generations is one of the task of major importance to the well being of the people and the economic development of all countries. Each State should ensure that activities on its territory do not cause degradation of the environment in other States. Recently accidental discharge from nuclear plant in Russia caused environmental pollution and damage in some of the adjoining European countries. The damage to environment should be avoided by preventive measures and the ecological balance must be preserved. There should be co-operation among countries in the field of environment, e.g., control of air, water and soil pollution, protection of marine, improvement of environmental conditions in areas of human settlement, etc.

International Conference on Environmental Education held at New Delhi on December 16-20, 1982, called for massive programme of environment education, research and monitoring. The Conference supported the views of Mrs. Indira Gandhi that poor people will support environmental programmes only when they are concerned about their benefits to them. Environmental education should start from childhood and it should be both formal and informal. Non-Government and voluntary organisations should encourage people in protecting their environment. Specialised institutions should give appropriate support by way of training and teaching materials to such organisations. In 1982 (15-16 January), an international public

hearing on "the Human Environment : Action or Disaster" was held. Dr. Mustafa Kamal Tolba, Executive Director of United Nations Environment Programme, declared : "Today, the option facing the governments is stark : take action or face certain disaster."

World Charter for nature, which was adopted by U.N. General Assembly on 28th October 1982, laid down principles of conservation by which all human conduct affecting nature is to be guided and judged. It declared that 'nature shall be respected and its essentials shall not be impaired.'¹⁴ Conservation of nature should be a part of every planning. Pollution should be avoided.¹⁵ The principles set forth in the Charter shall be reflected in the law and practice of each State as well as international level. Funds, programmes and administrative structures necessary to achieve the objective of the conservation of nature shall be provided. The States, public authorities, international organisations, individuals, groups, etc., should co-operate in this task. It mandated that each person has a duty to strive to ensure that objectives and requirements of the present Charter are met.

Non-aligned Conference (NAM) New Delhi

Mrs. Gandhi in her inaugural address observed : "Some people still consider concern for the environment an expensive and perhaps unnecessary luxury. But the preservation of the environment is an economic consideration, since, it is closely related to the depletion, restoration and increase of resources. In any policy decision and its implementation, we must balance present gains with likely damage in the not too distant future. Human ecology needs a more comprehensive approach." The Conference adopted a resolution¹⁶ appealing to the great powers to halt arms race which is consuming material resources and destroying the ecological balance.

CONSTITUTIONAL MANDATE

(a) *Fundamental Right* : Article 21 guarantees the right to life, a life of dignity, to be lived in a proper environment, free of danger of disease and infection. The Supreme Court through

its wisdom and activism has expanded this right and it is hoped that a day would come soon when it may declare environmental pollution dangerous to life as violation of Article 21 of the Constitution.

(b) *Fundamental Duties of the State* : Article 47 of the Constitution declares raising of the level of nutrition and the standard of living of its people and improvement of public health as one of the primary duties of the State. Similarly Article 48A¹⁷ provides :

“The State shall endeavour to protect and improve the environment and to safeguard forests and wild life of the country.”

Though it is a directive principle and thus not enforceable through courts, yet its directive character does not dilute its significance and the obligation of the State to protect and improve environment.

(c) *Fundamental Duty of Citizens* : Article 51A¹⁸ provides :

“It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.”

Thus it is the constitutional obligation of the State and the citizens to protect and improve environment.

LEGISLATION CONCERNING ENVIRONMENT

(a) *General Laws*

Indian Penal Code makes various acts affecting environment as offences :

- (i) Spreading of infection of any disease dangerous to life ;¹⁹
- (ii) Foulting of water of public spring or reservoirs rendering it less fit for the purpose for which ordinarily used ;²⁰
- (iii) Making atmosphere noxious to health ;²¹

(iv) Public nuisance ; ²² and

(v) Mischief.²³

The Code of Criminal Procedure (1973) authorises District Magistrates and SDMs to control and remove all pollution.²⁴

(b) *Special Laws*

Various special laws also help in protecting the environment, e.g., The Factories Act, 1948 ;²⁵ the Insecticides Act, 1968 ;²⁶ and Motor Vehicles Act, 1939.²⁷ After 1972 the Parliament has enacted a number of laws, directly relating to pollution control and environment protection, e.g., the Water (Prevention and Control of Pollution) Act, 1974 ; the Air (Prevention and Control of Pollution) Act, 1981 ; the Forest (Conservation) Act, 1980 ; the Wild Life (Protection) Act, 1972 ; the Wild Life (Protection) Amendment Act, 1986 ; and the Environment (Protection) Act, 1986. In addition to these, several State Governments have enacted special laws which can be evoked for protecting and improving environment.

(c) *The Environment (Protection) Act, 1986*

This Act has been passed by the Parliament of India to give effect to the decisions, taken at the Stockholm Conference in June 1972, relating to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property.

The Act lays down a comprehensive list of matters with respect to which the Central Government may exercise full powers for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating pollution.²⁸

To carry out these functions the Government may appoint a authority(ies) or an officer(s) to act on its behalf.²⁹ The Government may issue any directions under the Act including directions for (i) the closure, prohibition or regulation of any industry, operation or process, or, (ii) stoppage or regulation of the supply of electricity or water or any other service.³⁰

The Central Government may by rules provide for :³¹

- (a) Standards of quality of air, water or soil for various areas and purposes ;
- (b) Permissible limits of pollutants (including noise) for different areas ;
- (c) Procedure and safeguards for the handling of hazardous substances ;
- (d) prohibiting and restricting the handling of hazardous substances in different areas ;
- (e) prohibiting any restricting industries in different areas ; and
- (f) procedure and safeguards for preventing accidents which may cause environmental pollution and remedial measures thereof.

The Act mandates that no person carrying on any industry, process or operation shall discharge or emit or permit discharge or emission of any environmental pollutant in excess of permissible standard or limit. But where it does occur or is apprehended to occur due to any accident or unforeseen act or event, he or the person incharge of the place where it occurs or is apprehended must prevent or mitigate the environmental pollution caused by it, and must intimate and help the authorities concerned in preventing or mitigating pollution. Expenses incurred by such authority may be recovered from the concerned person as arrears of land revenue.³²

A person authorised by the Central Government shall have the right to enter and inspect any place, plant, etc., test equipment, etc., for achieving the object of the Act, in preventing or mitigating the pollution. The Officer empowered by the Government may take samples of air, water soil or other substance from any factory, premises or other place for analysis. The Government may establish or recognise environmental laboratories or appoint or recognise analysts for the analysis of air, water, soil or other substances.³³

Any person who fails to comply or who contravenes any provision of the Act or rules or directions under the Act shall be punishable with imprisonment for a term upto 5 years or fine upto 1 lakh rupees or both. If the offence continues,

additional fine upto Rs. 5,000/- per day after first conviction may be imposed.³⁴

In case the offence is committed by a company/firm etc., it shall be liable for the offence and the officer/director/manager responsible shall also be guilty of the offence unless he proves that it was committed without his knowledge or consent and that he took all due diligence and there was no neglect on his part.³⁵

In case, the offence is committed by a government department, head of the department shall be liable unless he proves that the offence was committed without his knowledge that he exercised all due difference to prevent it. Where it is proved that the offence was committed with the consent/connivance of or is attributable to any neglect on the part of an officer other than the head of the department, such officer shall also be deemed to be guilty of that offence or shall be liable for punishment.³⁶

Thus all persons directly or indirectly responsible for the offence by their actions/omissions or negligence, responsible for pollution, have been made liable for punishment under the Act. It is a welcome measure.

ENVIRONMENT DEPARTMENT

In 1980 the Government of India established a separate Department of Environment. It is supporting research on environmental problems and is giving high priority to environment education for creating environmental awareness. It is proposed to introduce environment education as a subject at school, college and university levels. Now, the Department is headed by a Cabinet Minister. That shows how much significance the government is now giving to it.

JUDICIAL ACTIVISM

Vardhichand³⁷ provoked the judicial consciousness of the Supreme Court to a problem which had not attracted that much attention. The Court also responded with equal anxiety and allowed the issue to come within the mandate of the Constitution. In this case the question related to the court's power to force public bodies under public duties to implement specific

plans, in response to public grievances, which related to environmental pollution.

Section 133 of the Criminal Procedure Code provides relief in case of public nuisance. The provisions of the Code, the Court declared, operate regardless of the cash in the coffers of public bodies, otherwise such bodies may legally defy duties under the law by arguing in self-defence or self-created bankruptcy or perverted expenditure budget. Although this section 133 of Cr.P.C. reads discretionary, but it has, according to the Court, a mandatory import, when facts for its exercise are present. Non-compliance of order under Section 133 Cr.P.C. is punishable under Section 188 IPC. The Court further observed : "Although these two codes are of ancient ventage, the new social-justice orientation imparted to them by the Constitution of India makes it a remedial weapon of versatile use. Social justice is due to the people and, therefore, the people must be able to trigger off the jurisdiction vested for their benefit in any public functionary like a magistrate under Section 133 Cr.P.C. In the exercise of such powers, the judiciary must be informed by the broader principle of access to justice necessiated by the conditions of developing countries and obligated by Article 38 of the Constitution."

Public nuisance because of pollutants being discharged by big factories to the detriment of the poorer sections, is a challenge to the social justice component of the rule of law. The nature of the judicial process is not purely adjudicatory nor it is functionally that of an umpire only. Affirmative action to make the remedy effective is the essence of the right which otherwise becomes sterile. Therefore, the Court armed with these two Codes must adventure into positive directions as it has done in the present case.

The Supreme Court further observed :

"Why drive common people to public interest action? Where Directive Principles have found statutory expression in Dos' and Donts' the Court will not sit idly and allow municipal government to become a statutory mockery. The law will relentlessly be enforced and the plea of poor finance will be poor alibi when people is misery cry for justice."

The dynamics of the judicial process has a new 'enforcement' dimension not merely through some of the provisions of Criminal Procedure Code but also through activated tort consciousness. The officers in-charge and even the elected representatives will have to face the penalty of the law if what the constitution and follow-up legislation direct them to do are defied or denied wrongfully."^{37a}

The Supreme Court issued the following mandatory directives for execution by the Ratlam Municipal Council :³⁸

- (a) The Municipal Council must complete the execution of the work to provide proper drainage system within one year, for which the work must start within two months. The magistrate shall inspect its progress every three months.
- (b) The Municipal Council must take action to stop effluents from the Alcohol Plant flowing into the street. The State Government shall also take steps to stop pollution.
- (c) The Municipal Council must construct, within 6 months, a sufficient number of public latrines, provide for water supply and scavenging service in morning and evening to ensure sanitation. Health officer shall report at the end of 6 monthly-term.
- (d) The State Government shall give special instructions to Malaria Eradication Wing to stop mosquito breeding in Ward No. 12.
- (e) The Municipal Council must fill up cess pools and other pits of filth.
- (f) If these directions are not complied with, the S.D.M. will prosecute officers responsible and the Supreme Court may consider punishment for contempt.

The Supreme Court, thus directed affirmative action to abate pollution and to ensure healthy environment.

The decision of the Madras High Court in *A.K. Thangadurai v. D.F.O., Madurai*,³⁹ exhibits a negative attitude inconsistent with the national policy and violative of the constitutional directive laid down in Article 48A. It shows the lack of

appreciation of the public needs. The court put the seal of judicial approval on the government policy for lease of forest land when it held :

“Safeguarding of the forest contemplated in Article 48A does not mean that the State Government cannot lease out the forest lands for the purpose of cultivation and for realising the revenue therefrom. Therefore, nothing in Article 48A stands in the way of the State laying down its own policy and criteria for the lease of the forest lands for cultivation.”⁴⁰

The court was wrong in giving blanket power to the government to lease forest lands, showing total apathy to the need of preserving forests, so essential for healthy environment.

The Supreme Court got another opportunity to consider issues relating to environment and ecological balance which are of great significance to the welfare of the people in the country.⁴¹ This case brought into focus the conflict between development and conservation and served to emphasise the need for reconciling the two in the larger interest of the country.⁴² Though the Supreme Court passed an order and stopped mining operation in certain areas, but it has not given its judgement till November 1986, though the order appeared in A.I.R. issue of June 1985.

The environmental disturbance has to be weighed in the balance against the need of lime-stone quarries for industrial purposes in the country and this aspect was taken into account by the court while making the order. The court ordered the closing down of the lime-stone quarries in Dehra Dun-Mussoorie area. The court realised the financial hardship that may be caused to the lessees and the workers, so it directed that in future if any area is thrown open for quarrying by the Government in U.P., the lessees who are displaced by this order shall be given priority and the workmen who are being thrown out of employment shall be employed in the afforestation and soil conservation programme which may be taken up in this area. Thus, the court tried to mitigate the hardship being created by this order passed for protection of environment and ecological

balance. However, the court, referring to the financial loss and hardship to lessees, observed :

*“This would undoubtedly cause hardship to them, but it is a price that has to be paid for protecting and safeguarding the right of the people to live in healthy environment with minimal disturbance of ecological balance and without avoidable hazard to them and to their cattle, homes and agricultural land and undue affectation of air, water and environment.”*⁴³

LEGAL AID

Our judicial system has been described as slow and costly. It is a finished product of great beauty, but entails an immense sacrifice of time, money and talent. It gives justice only when the parties can surmount substantial barriers which it erects to most people. When the public bodies do not perform their statutory public duties and the interest of the community is jeopardised, justice process has to be set in motion to train the judicial guns. But the unfortunate reality is the people's ignorance of their rights and procedural techniques to evoke jurisdictional consciousness. Article 21 guaranteeing right to life and personal liberty has now been widely interpreted by the Supreme Court so as to include the right to free legal assistance.⁴⁴ Article 39A⁴⁵ also provides that the State shall secure that operation of the legal system promotes justice on the basis of equal opportunity and shall in particular provide free legal aid by suitable legislation or schemes or in any other way, to ensure that opportunities for securing justice are not denied to any citizen by reason of economic or other disabilities.

So free legal aid should be provided to the suffering people to enforce their rights. Legal Aid Programme in its wider connotation has a positive role to play. Legal aid clinics/bodies should educate the people about their right and duty and remedial process to achieve the goal of protecting and improving environment by preventing pollution. These bodies should also take up the issues before courts so as to ensure pollution free environment. Free legal advice and assistance for enforcement of the right to unpolluted environment through the courts will

go a long way in the ultimate success of environmental protection and improvement campaign and in making real and meaningful the rights and duties of the people to live in and keep unpolluted environment, which is essential for a happy life.

References

1. *Ratlam Municipality v. Vardhichand*, AIR 1980, SC 1622.
2. Suresh Jain, *Environmental Law in India*, (1984), p. 543.
3. Stockholm Declaration, 1972, Principle 1.
4. Emphasis own.
5. *Ibid.*
6. Stockholm Declaration, Principle 2.
7. *Id.*, Principle 4.
8. *Id.*, Principle 6.
9. *Id.*, Principle 7.
10. *Id.*, Principle 8.
11. *Id.*, Principle 13.
12. *Id.*, Principle 12.
13. Margaret R. Biswas and Asit K. Biswas, "Stockholm : Ten Years After" *Mazingira*, Vol. 6, No. 3, (1962), p. 5.
14. Charter, Principle 1.
15. Principle 12.
16. Resolution No. 13 adopted on 7th March, 1983.
17. Added by the Constitution (42nd Amendment) Act, 1976.
18. *Ibid.*
19. Section 269.
20. Section 277.
21. Section 278.
22. Section 290.
23. Sections 425, 426, 430, 431 and 432.
24. Sections 133, 143 and 144 of the Code.
25. See Section 12.
26. See Section 27.
27. See Section 70.
28. See Section 3 (2) of the Act.
29. See Section 4 of the Act.
30. See Section 5 of the Act.
31. See Section 6 of the Act.
32. See Sections 7 & 9 of the Act.
33. See Sections 12 to 15 of the Act.
34. See Section 15 of the Act.
35. See Section 16 of the Act.
36. See Section 17 of the Act.

37. See *Ratlam Municipality v. Vardichand*, AIR 1980, SC 1622.
- 37a. *Ib id.*
38. AIR 1980, SC 1622 at pp. 1630-31.
39. AIR 1985, Madras High Court 104.
40. *Ibid.*, p. 111.
41. *R.L. & E Kendra Dehra Dun v. State of U.P.*, AIR 1985, SC 652.
42. *Ibid.*
43. *Ibid.* at. p. 656.
44. *H.M. Hoskot v. State of Maharashtra*, AIR 1978, SC 1548;
Hussainara Khatoon v. State of Bihar, AIR 1979, SC 1369; *Khatri*
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Role of Income Tax Incentives in the Control Mechanism of Environmental Pollution

BAL KRISHNA*

Introduction

Since independence rapid industrial and technological growth has taken place in our country. Industrial and technological growth is essential for a developing society. In turn it causes certain effects particularly in the area of environment. Therefore, it is necessary to think of various ways and means to deal with the situation.

The Government is conscious of this fact and has adopted various measures for controlling environmental pollution. By Constitution (Fortysecond Amendment) Act, 1976, Chapter IV A was incorporated in the Constitution of India which lays down Fundamental Duties of the Citizens of India. Clause (g) of Article 51A provides:

“It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.”

By the same Amending Act, Article 48A was added in Chapter IV which deals with Directive Principles of State

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Policy whereby directive is given to the State for the protection and improvement of the environment.¹

In pursuance of the above mentioned directive, the Government has given several incentives to the assesseees under the Income-tax Act, 1961 for the control of environmental pollution. In this Chapter, it is proposed to discuss in brief various provisions of the Act which deal with such incentives and to suggest changes in the existing provisions.

Depreciation

Under the existing provisions in the Income-tax Act, 1961 by section 32, normal depreciation on plant and machinery is allowed at the rate of 15 per cent of its cost.² But in respect of devices for minimising environmental pollution, the depreciation is allowable at the rate of 30 per cent.³ This has been done with a view to encourage the industries for using such devices whereby the environmental pollution is considerably reduced. A list of qualifying items is given in Appendix I to Income-tax Rules, 1962, which is are under:

“(10B) (a) Air pollution control equipments, being—

- (i) Electrostatic precipitation systems
- (ii) Felt-filter systems
- (iii) Dust collector systems
- (iv) Scrubber-counter current/venturi/packed bed/cyclonic scrubbers

(b) Water pollution control equipments, being—

- (i) Mechanical screen systems
- (ii) Aerated detritus chambers (including compressor)
- (iii) Mechanically skimmed oil and grease removal systems
- (iv) Chemical feed systems and flash mixing equipment
- (v) Mechanical flocculators and mechanical reactors
- (vi) Diffused air/mechanically aerated activated sludge systems

- (vii) Aerated lagoon systems
- (viii) Biofilters
- (ix) Methane-recovery anaerobic digester system
- (x) Air floatation systems
- (xi) Air/Steam stripping systems
- (xii) Urea hydrolysis systems
- (xiii) Marine outfall systems
- (xiv) Centrifuge for dewatering sludge
- (xv) Rotating biological contractor or bio disc
- (c) Solid waste control equipments, being caustic/lime/chrome/mineral/cryolite recovery system."

The legislature has made this provisions in order to give incentive to the assessee but actually it does not work out to be of much benefit. The reason being that though it helps in reducing the taxable income in the initial years of installation of anti-pollution devices but in effect the assessee is allowed to recoup the actual cost of such devices at accelerated rate and nothing more. Thus it results only in the postponement of the tax.

Investment Allowance

By section 32-A of the Income-tax Act, 1961, subject to the fulfilment of certain conditions, assessee is allowed deduction by way of Investment Allowance equal to a sum of 25 per cent of the cost of plant and machinery. This section was incorporated in the year 1976 with a view to encourage investment in new plant and machinery for the industrial undertakings. In the original section 32-A, there was no extra incentive provided to the assesseees for installing plant and machinery for the control of environmental pollution. By the Finance Act, 1983 sub-section (2C) has been added to section 32-A which *inter alia* provides that where any new machinery or plant is installed after 31.5.1983, which would assist in control of pollution or protection of environment, the assessee will be entitled to investment allowance at a higher rate *i.e.*, 35 per cent of the cost of such plant and machinery. The newly added sub-section

specifically provides that the machinery or plants which would qualify for higher rate of investment allowance are to be notified by the Central Government in the Official Gazette. Air/water pollution and solid waste control equipment have since been notified in item III (ii) D (10B) of Part I of Appendix I to the Income-tax Rules.

The benefit conferred by this section is over and above the depreciation allowance allowable to the assessee. Thus the assessee will not only be in a position to recoup the cost of such plant and machinery by claiming depreciation allowance but will also have funds for renovation and replacement of such devices. These funds he will be having in the form of Investment Allowance Reserve which the assessee is statutorily required to create⁴ and is also required to use that for acquiring new plant and machinery.⁵

The scheme of Investment Allowance has been replaced by a new scheme of Investment Deposit Account by insertion of section 32AB by the Finance Act, 1986. This new scheme will be effective from April 1, 1987. Under this scheme a deduction will be allowed upto 20 per cent of the profits of the eligible business if the same is deposited in an account maintained by the assessee with the development bank before the expiry of six months from the end of the previous year or before furnishing the return of income whichever is earlier or is utilised during the previous year for purchase of new machinery or plant. In other words the entire cost of plant or machinery qualifies for deduction if the same is upto 20 per cent of the profits of the business. But under this scheme no extra-incentive is provided to assesseees who instal plant and machinery for the control of environmental pollution. It is submitted that suitable changes be made in this scheme whereby some extra incentive is given to the assesseees who invest in plant and machinery for control of environmental pollution.

Expenditure by Way of Payment of Associations and Institutions for Conservation of Natural Resources

Section 35CCB was inserted in the Income-tax Act, 1961 in the year 1982 with a view to encourage liberal donations to associations or institutions which are engaged in programmes

of conservation of natural resources. This section provides that sums paid by taxpayer carrying on business or profession to any association or institution, which has as its object the undertaking of programmes of conservation of natural resources to be used for such programmes, will be allowed as a deduction in the computation of taxable profits. The deduction under this section is allowed only when the association or institution, as also the programme of conservation of natural resources for which such sums are paid, have been approved by the prescribed authority. For the purposes of this section the prescribed authority is the Secretary, Department of Environment, Government of India.⁶ The prescribed authority is debarred from approving an association or institution for this purpose for more than three years at a time.

For taxpayers who are not carrying on business or profession, such deduction is permissible under section 80GGA (2)(c)⁷ which provides that any sum paid by the assessee in the previous year to an association or institution, which has as its object the undertaking of any programme of conservation of natural resources, to be used for carrying out any programme of conservation of natural resources shall be deducted at the time of computing the total income of the assessee.

The absence of such a provision would have disintitiled the assessee from claiming deduction in respect of such payments. The reason is obvious as such payments cannot be regarded as wholly and exclusively for the purpose of assessee's business for being allowed as deduction under section 37 of the Act. It is submitted that mere allowability of such payment as deduction is not a sufficient incentive to assessee's for making payment to associations or institutions engaged in any programme of conservation of natural resources. It would be better if weighted deduction is allowed to the assesseees at the rate of one and one third time of the payment made to such associations or institutions so that assesseees are encouraged for making such payment.

Section 37 and Judicial Interpretation—A Step Forward

Section 37 of the Income-tax Act, 1961 lays down general

rules for the allowability of any expenditure as deduction while computing the income from business or profession. According to this section, any expenditure which is wholly and exclusively for the purposes of business or profession is deductible at the time of computing the income chargeable under the head 'Profits and gains of business or profession.' *Inter-alia* expenditure in the nature of capital expenditure or personal expenses of the assessee is not allowable deduction under this section. A question of law came for consideration before Gujarat High Court in *CIT v. Navasar Cotton & Silk Mills Ltd.*⁸ as to whether a contribution made to a municipality by a company for providing a pipeline through the municipal land for the disposal of the effluents discharged by the company so as to guard against health hazards to the citizens is allowable revenue expenditure. In this case the company contributed Rs. 1,80,000 being its share of contribution at 20 per cent of the total expenditure to Navsari Borough Municipality by way of betterment charges for the underground drainage line. It was contended on behalf of the Revenue that the contribution made by the company being capital expenditure is not allowable deduction under section 37 of the Act. On the other hand it was argued *inter alia* by the assessee company that:

- (a) the effluents discharged by it were creating a health hazard as the drain in which the same were being discharged used to overflow;
- (b) the citizens and agriculturists affected by the aforesaid phenomenon were loudly and strongly protesting in this behalf; and
- (c) it could reasonably apprehend a spate of suits instituted by the citizens in order to prevent the alleged nuisance which endangered their health and safety.

It was held that contribution made by the company is revenue expenditure and is allowable deduction. The court laid down the following positive test for determining the allowability of the expenditure:⁹

"Where it is incurred solely by way of civil duty owed by the assessee to the society having regard to the nature of

his business which brings him profits but results in some detriment to the public at large either by way of health hazard or ecological pollution or serious inconvenience to the citizens with a view to mitigate the aforesaid evil consequences of a like nature, subject to its being genuine and within reasonable limit.”

The court specifically pointed out that if any expenditure is incurred for a mere altruistic consideration or mainly in order to satisfy his philanthropic urges shall not be allowable deduction even though these are laudable. Such urges can be satisfied at one's own cost or sacrifice but not at the cost of public exchequer or other tax-payers and those living below the poverty line. So also any expenditure incurred mainly in order to win applause or earn garlands or public appreciation is not allowable deduction.

It is submitted that this judgement will go a long way in providing basic amenities to the public where industry is a party to the environmental pollution. The industry is in fact duty-bound to do the needful either itself or in collaboration with local authorities. It is hoped that local authorities in such situations may not be starved of funds because industry will not be hesitant in contributing its share because such contributions will be deductible expenditure under section 37.

Conclusion

In the light of the above discussion, it can be concluded that income-tax incentives provided to the industries are not in consonance with the gravity of the problem. The provision for loaded deduction suggested in the preceding paragraphs is urgently needed. Further a scheme of disincentives be carved out in the Act whereby it be provided that industries which are contributing towards environmental pollution and are not adopting effective measures to control it, shall not be entitled to the benefit of tax-holiday under section 80-I of the Income-tax Act and certain percentage of expenditure incurred by them in carrying on the business shall be disallowed. Such disincentives would deter the industries and would act as stimulant for adopting devices for controlling pollution effectively.

1. Article 48A reads thus : "State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country."
2. Earlier it was 10 per cent. From the assessment year 1984-85 it has been raised to 15 per cent.
3. The Taxation Laws (Amendment and Miscellaneous Provisions) Act, 1986 has incorporated new provisions for allowing depreciation in respect of block of assets. In his Budget speech for the year 1986-87, the finance Minister had announced that "plant and machinery used as anti-pollution devices...(is) proposed to be placed in a block carrying the higher rate of depreciation of 50 per cent." Necessary amendment in the Income-tax Rules, 1962 prescribing the rate of depreciation in regard to this block is yet to be made which will be operative from the annual year 1988-1989.
4. Section 32A (4) (ii) of the Income-Tax Act, 1961.
5. Section 32A (5) (b) of the Income-Tax Act, 1961.
6. See Rule 6AAC of Income-Tax Rules, 1962.
7. Inserted by the Finance Act, 1982 with effect from 1. 6. 1982.
8. (1982) 135 ITR 546.
9. *Ibid.*, at p. 555.

Judicial Dynamism : The Environmental Pollution Case

C.M. JARIWALA*

The Bhopal catastrophe has started a debate whether the Indian Judiciary is competent or well-equipped to handle cases of complex technology. The foreign observers are of the view that "the Indian judicial system, is ill-prepared to handle a case of this nature" or "Its judicial system does not possess the legal concepts, procedural machinery, or experience to process an environmental disaster."¹ On the other hand it has been defended that the Supreme Court of India is one of the most highly innovative courts and is arguably the most powerful court in the world." It has been further pointed out that "In sum, the courts in India have been very progressive when called upon to act in a wide variety of complex areas."² In this discussion *Ratlam Municipality v. Vardhichand*³ is an important case which may throw some light on the response of the Indian judiciary in the complex socio-economics of pollution.

*Ratlam Municipality*³ is an important pronouncement in the area of public nuisance pertaining to environment pollution. In order to better appreciate the case, the facts of this case may be given in detail. On the southern side of New Road of Ratlam Municipality some houses were situated and behind these houses and attached to the college boundary the municipality constructed a road and this new road touched the Government College and its boundary. In between the said area a dirty Nala (stream)

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was flowing which was in the middle of the New Road just in heart of the city. In this stream many a time dirty and filthy of alcohol plant having chemical and obnoxious smell was released. This filth also caused a bulk of mosquitoes breeding. The half constructed drain allowed dirty water to flow. This gave rise not only to dirt and mosquitoes but also caused harm to nearby houses. Moreover, the slum dwellers used the bank of drains as an open latrine. The dirty water flowing from the lavatories and urinals of the residential houses had no outlets and the pits were full of this dirty water. The malaria department of the State was also negligent in eliminating mosquitoes. Against this many applications were submitted to remove the nuisance but all of them fell on deaf ears. Many a time people tried to attract the attention of Municipal Council and the Town Improvement Trust through "their returns, notices and even personal appearance but without any result. In view of direct breach of duty and public nuisance and active neglect, the sub-divisional Magistrate, Ratlam was moved to take action under section 133 of the Criminal Procedure Code to abate the nuisance, by ordering the Municipality to construct drains, remove the filth and stop the despoliation.

The magistrate held that both the authorities had "taken no steps whatsoever to remove all these public nuisances" and issued order to the municipality and the town improvement trust to remove all the nuisance and undertake certain works within 15 days. This order was declared unjustified by the Sessions Court but the High Court, upholding the order, ruled that both the authorities must prepare a permanent plan for the free flow of dirty water of the Nallah and must give a concrete form within six months that proper drainage system must be contructed within six months; that the places having pits should be covered with mud so that the water may not accumulate there and it may not breed mosquitoes. This work should be completed within two months."

The Supreme Court, while upholding the order of the sub-divisional Magistrate, issued further supplementary directions "specifically enjoin upon the municipal authority and the State government to carry out certain directions which included that the municipal council and the State Government shall take steps to stop the pollution caused by the alcohol plant" and the sub-

divisional Magistrate will use his power under section 133 of the Indian Penal Code to abate the nuisance so caused; that the council shall, within six months, construct a sufficient number of public latrines with water and scavenging services to ensure sanitation; that the State government will give special instruction to its malaria eradication wing to stop mosquito breeding in Ward Number 12; that the cess-pools and other pits of filth will be filled by the municipal council and see that such places are free from accumulations of filth ;” and finally it laid down that, “in case of any violation of these directions, the Magistrate will prosecute the officers responsible and for wilful breach of duty, a contempt proceeding may start against them.”

Before going into the nicety of the case it will not be out of place to discuss the statutory provisions involved in this case and the response of the judiciary. Section 123 of the Madhya Pradesh Municipalities Act, 1961 imposed certain duties on the municipality which included, the duty to undertake and make reasonable and adequate provisions for cleansing of public nuisances, etc. This section was interpreted by the Supreme Court as “mandatory provision” and the municipality was not allowed to escape its mandatory duty simply by showing its financial inability. There was no exception to section 123 which exempted the authority from performing its duty and the court rightly did not allow the council to shrink from its primary responsibility of proper sanitation. If such plea is allowed then in the words of Krishna Iyer, J. :

“A profligate statutory body or pachydermic governmental agency may legally defy duties under the law by urging in self-defence a self-created bankruptcy or perverted expenditure budget.”⁴

Section 133 of the Criminal Procedure Code provides that whenever a District Magistrate or a Sub-Divisional Magistrate or another executive Magistrate so empowered on receiving the report from appropriate authority considers that any unlawful obstruction of nuisance should be removed from any public place, such magistrate may by order require such person to remove the obstruction or nuisance within a time to be fixed in the order. Thus this section will operate whenever there is public

nuisance and the magistrate is under a "public duty" which he owes to the members of the public who are victims of the nuisance and "he shall exercise it."⁵ The Court pointed out, "Discretion becomes a duty when the beneficiary brings home the circumstances for its benign exercise."¹ The plea of the petitioners to exonerate them from statutory liability was turned down under this section also. The court took the stand that the provision of Criminal Procedure Code operated "regardless of the cash in their coffers."

Once the magistrate issues order under section 133 of the Criminal Procedure Code and if defied or ignored then penal sanction under section 188 of the Indian Penal Code will be attracted. Section 188 which *inter alia*, provides that whosoever disobeys such order which causes or tends to cause danger to human life, health, etc., "shall be punished with imprisonment of either description for a term which may extend to six months or with fine which may extend to one thousand rupees or with both." Thus section 133 of the Criminal Procedure Code read with section 188 of the Indian Penal Code, the Officer in charge and even the elected representatives cannot escape the penal sanction. The Court, while reading together both the sections, laid down that the prohibitory act was made a mandatory duty.

The above facts bring to light the most important problem of the lengthy remedial process. The law provides for protection against public nuisance including environmental pollution but a long heirarchy of judicial processes will not give immediate relief to those suffering from pollution. The present case came up for magisterial remedies in the year 1972, followed by decisions of the Sessions Court and the High Court. In 1979 the special leave petition was moved and it was handed down by the Supreme Court of India on 29th July 1980. This means that it took in all eight years for the judicial remedies to be available. And in spite of the Supreme Court's order the public of the New Road, Ratlam will still have to bear with the aggravated form of pollution during the current rainy season. It is submitted that the matter of such dimension, where the life of people is in peril, cannot be left to long judicial dissection and thereby allow the State environmental engineering to remain inactive and in this state of affairs the whole system would "crumble under the

burden of its own insensitivity.”⁶ In this case the municipality scared from any prosecution under the law” rushed from court to court.” For such a long delay Justice Krishna Iyer throws the ball in the court of the municipality and he opines:

“Had the municipal council and its executive officers spent half this litigative zeal on cleaning up the street and constructing the drains by rousing the people’s *sramdan* resources and laying out the city’s limited financial resources, the people’s needs might have been largely met long ago.”⁷

The expensive and dilatory judicial process according to the learned judge, is not necessary “if responsible bodies are responsive to duties.” What has been said by the learned cannot be denied but our legal system is also responsible as it has provided for litigative process. And in such system not only the people of New Road had to suffer but the whole human race of the Bhopal Tragedy were suffering and only time can tell when their sufferings will come to an end. These developments lead to one direction that the litigative zeal may be shortened by constituting a separate environmental court whose decision shall be final; however, an appeal may lie to the Supreme Court against its decision is the environmental court certifies that the case involves a substantial question of national importance. Such a separate body will gear up the long litigative process. Moreover in this court when environmental engineering experts are also elevated to the Bench then the engineering justice may be more balanced.

The surprising part of the case was that Vardhichand and other applicants produced witness and documents in support of their case. But the non-applicants (Municipal Council and Town Improvement Trust) did not produce any evidence in spite of the fact that they were given “so many opportunities.” The Municipal Council, however, “sought six times to produce evidence” but “all in vain”. The lukeworm approach was due to the fact that the stream which generated the environmental litigation was claimed to be no body’s child. The municipality and the town improvement trust both disputed their jurisdiction in the matter and thus avoided handling work of the top priority of public interest. If the State⁸ itself starts disowning its own responsibility in the area of environmental pollution

on the technical ground, we can very well understand its impact on the private polluters and their impact on the environment as a whole.

In this case the petitioners, in order to escape the penal sanction, took a strange plea, "that the owners of houses had gone to that locality on their own choice with eyes open", and therefore, they "could not complain if human excreta was flowing, dirt was stinking, mosquitoes were multiplying and health was held hostage."⁹ The High Court rightly repelled this contention. It may be pointed out that the plea of estoppel cannot be available to allow the State to become inactive where positive mandatory duty is imposed. The social justice envisaged under the Indian Constitution requires socialized action. It will be mockery of the provisions of the constitution imposing obligation on the State to protect public health and environment. Why can't we think otherwise that those who moved in this locality moved with the hope that one day good sense will prevail on the authority to improve the existing environment. Thus it was rightly pointed out that, "the public body cannot outrage the court by such an ugly plea."¹

The other plea which the municipal council had taken was the financial bankruptcy in gearing up the environmental engineering. It is true that the gross-root machinery does not get the appropriate financial share to be dynamic. The financial inability hinders them from performing their functions but if the municipalities are responsive to their constitutional obligation, they would have made some attempt in that direction. On the contrary even though eight long years have passed, since the residents brought to their notice the matter, still the authorities are in long hibernation. As pointed out earlier that the preservation of public health is the "principal duty" of the municipality, it cannot run away from it by pleading financial inability. Thus "the plea of poor finance will be poor alibi when people in misery cry for justice." Once this is laid down, can the judicial process go to the extent of laying down the cost and the time within which the directions have to be complied with? Justice Krishna Iyer, a dynamic justice, has crossed the barriers of the judicial justice and entered into technocratic justice and laid down that "The court must go further to frame a scheme and then fix time-limits." In this

wave length the learned judge approved out of three alternatives the scheme costing Rs. 6 lakhs for the completion of the work. The economy of public nuisance, especially the environmental pollution, required the judiciary to use commercial balance to weigh the conflicting interests. And in this balancing the court examined the overall cost burden on the municipal exchequer for their inaction. The court come to conclusion that the increase in the medical services impose a greater economic burden. Krishna Iyer, J., while endorsing the above plea, was not unaware of the council's financial liability and directed the State government to contribute by way of loans or grants sufficient finances to meet the local sanitary needs. Further the court directed the municipality also to "slim its budget on low priority items and elitist projects to use the savings on sanitation and public health." The dynamism is also reflected when the judiciary at the gross root" inspected the site" to fully satisfy itself with the problem of public nuisance.

In some cases the courts have to swing into action as soon as possible and required the concerned authorities to act forthwith."¹⁰ But the economy of pollution requires a reasonable time for action in the matter. The applicants, who moved for magisterial remedies, required "action forthwith." The Sub-Divisional Magistrate satisfied with the public nuisance and carried by the 'forthwith' request directed "the authorities to remove all the nuisances within 15 days." Looking to the enormous construction work involved in the direction given by the magistrate, it would not have been humanley possible to complete all the formalities and remove the public nuisance. Iyer, J., foregoing the idealistic view, swang in the pragmatic direction. And tailoring the magisterial direction to be more workable, the court fixed "a time limit of one year for completing execution of work according to that scheme,"¹¹ and further directed, "the work shall be begun within two months from to-day and the magistrate shall inspect the progress of the work every three months.

It is submitted that the above judicial dynamism has given a new dimension to the environmental justice. The judicial hands off in the inaccessible area of the ancient vintage or a too legalistic approach would allow more nuisance in this polluted world. The developing branch of law, like the environ-

mental law, cannot and should not be tailored to suit the grammatical approach. The judicial process must transfuse new blood in the skeleton to infuse life in the statutory provisions. The techno-engineering law cannot foresee the regulation of all the circumstances. In view of this fact, the judiciary "will not sit idly by and allow municipal government to become a statutory mockery." However, in the activist role, the judiciary must not forget the limitation of its directive powers.¹²

The judicial socialised action is reflected in Krishna Iyer's justice when he, unlike the Sub-Divisional Magistrate, was not influenced by the fact that "cultured and educated people live in this area. "He emphasised that, in India" one man one value' is the democracy of remedies and to rich or poor the law will call to order."¹³ It may be mentioned that the attainment of social justice is one of the basic postulates of the Indian Constitution and the judiciary cannot neglect it. The access to justice cannot be the monopoly of the elite, it has to reach the sufferings of the poor as well. The cultured and educated people are not the most sufferer in this game. The slum and pavement dwellers, who cannot think of mosquito nets, scent and perfumes and other luxuries to combat of the environmental pollution, have greater sufferings than those in the rich palaces. In this sense the poverty cannot be pushed in the background.

The *Ratlam Municipality* will go a long way in the history of environmental justice. The judicial consciousness of keeping the locality pollution free is a great social justice .

In the present case the judiciary at the grass root to the top above has done a commendable job. It has crossed the barriers of traditional system of administration of justice and played the role of environmental planner, determining the cost and time for the project. It remedied the sufferings of the people when the bureaucracy was playing hide and seek with the public health. Today in the inactive administrative jurisprudence the judiciary has to share great responsibilities. Is the role of such a judiciary not a very progressive and highly innovative? Will it not be baseless to label the Indian judiciary as "incompetent and ill-equipped." In spite of the judicial dynamism which has awoken those who were in hibernation, still

the question remains : How far the New Road itself and other roads of the country are free from the aforesaid public nuisance ? The people's participation and use of criminal sanction, are some of the medicines which may make the responsible responsive.

References

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2. *In Convenient Forum and Convenient Catastrophe*, prep. by Upendra Baxi, 1986, pp. 74-75, (Dadachand ji Affidavit.).
3. A.I.R. 1980 S.C. (Hereinafter referred as *Ratlam Municipality*)
4. *Id.*, at 1628.
5. *Id.*, at 1627.
6. Sikas, *Administration of Injustice*, cit in *Ratlam Municipality*, *Id.*, at 1623.
7. *Ibid.*, 1624.
8. 'State' here means 'state' in Article 12 having widest meaning given by the judiciary.
9. *Id.* at 1630.
10. See, for example, cases in the area of Personal Liberty Jurisprudence, where the court ordered the detenu to be released 'forthwith.'
11. *Id.* at 1630.
12. The Supreme Court of India in many cases issued directions upon directions on the Government of Bihar with hardly any response. See A.I.R. 1979, S.C. 1360.
13. *Id.* at 1629.

Enforcement of Environmental Law and Management of Pollution Control

M.R. GARG* AND N.S. TIWANA**

Introduction

The ardent lover, true worshipper and a sincere admirer of nature, poet Wordsworth has said "what man has made of man little do we see in nature that is ours."¹ Current population explosion and ever-increasing expansion of industry has caused cancer to the environment. Probably the scientists, economists and the planners have forgotten the law of Newton that every action has an equal and opposite reaction. Therefore, the environmental cancer in return is causing cancer² to the entire humanity. Today we find not only India but every nation on the globe is concerned about the ever increasing menace of environmental pollution. It is said that a stitch in time saves nine. It is high time to strive and struggle against this most dreaded disease. Therefore, we should not put off till tomorrow whatever we can do today. The cancer is in its primitive stage. Early prevention and treatment is expedient. Yesterday's carelessness is always a cause of concern for tomorrow.

The echo of the hue and cry raised through the press, courts,³ social organisations,⁴ educational institutions⁵ have

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awakened the Government of India and the States to this impending problem. In spite of the fact that there are about two hundred statutes on the statute book containing provisions to check the environmental pollution, the Government of India felt the necessity to supplement the existing provisions of law by enacting the Water (Prevention and Control of Pollution) Act,⁶ Air (Prevention and Control of Pollution) Act,⁷ (Prevention & Control of Pollution) Cess Act,⁸ Wildlife Act⁹ and Environment (Protection) Act, 1986.¹⁰ But the real difficulty is not in passing the laws but in their implementation. Law cannot work without public co-operation. It is the social conscious which has to be aroused to make public policy a success.

Indian Constitution and Environment

No country on the globe except India has given a constitutional status to the law relating to environmental control, protection and preservation. Specific provisions were already there. But recently more provisions¹¹ have been added in the body of the constitution thereby making it obligatory on the State and every citizen to protect and improve the environment.

The Constitution (Forty Second Amendment) Act by inserting words "Socialistic secular"¹² in the preamble has made amply clear the nature and pattern that the Indian society shall endeavour to accomplish. The preamble in every broad terms speaks of the dignity of the individual and the Parliament of India through Article 39(f)¹³ has imposed a positive duty on the State to direct its policy to secure for children opportunities and facilities to develop in a healthy manner and conditions of freedom and dignity. Clean, neat, free and unpolluted environment certainly helps in maintaining and attaining dignity. Our Supreme Court has observed that "the constitution is an organic document which must grow and it must take stock of the vast socio-economic problems particularly by improving the lot of common man consistent with dignity."¹⁴

But to talk of fundamental rights and individual dignity is meaningless unless they secure the minimum liveable circumstances. The economic prosperity breeds pollution is as true as familiarity breeds contempt. But this does not mean

that we should not advance economic development. Rather while maintaining the pace of economic development we have to strive to minimise the pollution. It is said that a man is known by the company he keeps. It does not mean the company of his fellow being only, rather it means the totality of the environment in which he has been brought up and resides. Environment plays a role not less important than anything else in the development of individual personality and dignity. Therefore, to develop and maintain in the dignity of the individual is not only the concern of that individual but it is also the concern of State.

Right to breathe in free and fresh air, consume contamination free water, reside, walk and travel in noise free environment is guaranteed by Article 21¹⁶ to all the residents of India.

Even the right to religion guaranteed in Articles 25¹⁷ and 26¹⁸ is subject to public health. Articles 31(5) (b)(ii) exempted the promotion of public health from the provisions of Article 31(2) relating to compensation.¹⁹

Under the Indian Constitution the States are to look after the environment not only at the instance of the courts when an individual is seeking the enforcement of his right, but the framers being conscious of the problem imposed positive duty on the State through Chapter IV to enforce these provisions of the Constitution as a part of their political manifesto. The positive duties which every political party must endeavour to discharge are :

- (a) *Article 42* : The State should make provisions for just and human conditions of work.
- (b) *Article 43* : Securing living wage is not enough. State should endeavour to ensure decent standards of life.
- (c) *Article 47* : State to raise the level of nutrition and standard of living and to improve public health.
- (d) *Article 48* : State to organise agriculture, animal husbandry.
- (e) *Article 48-A* :²⁰ State shall endeavour to protect and improve the environment and to safeguard the forests and wild-life of the country.

- (f) *Article 49* : State to protect every monument and place of historic interest or national importance from spoilation, disfigurement, destruction etc.
- (g) *Article 51-A(g)* :²¹ It specially deals with fundamental duty of every citizen of India to protect and improve the national environment (whereas under Article 21 every person can claim the right against pollution but the duty is only of the citizens).

Environmental Legislative Powers

Indian Constitution exhaustively deals with legislative powers relating to environmental law. These have been distributed between the Union and the States²² as the environmental legislative powers and available in all the three Lists of VII Schedule of the Constitution which are as under :

List I (Union List) Entries

- (a) 52-Industries.
- (b) 53-Regulation and Development of oil fields and mineral resources.
- (c) 54-Regulations of Mines and Mineral Development.
- (d) 55-Regulations and development of inter-State rivers and river valleys.
- (e) 57-Fishing and Fisheries beyond territorial water.

List II (State List) Entries

- (a) 6-Public Health.
- (b) 14-Agriculture, Protection against pests and prevention of plant disease.
- (c) 18-Land, Colonisation etc.
- (d) 21-Fisheries.
- (e) 24-Mines and Minerals subject to the provisions of List-I.
- (f) 25-Industry subject to the provisions of List-I.

List III (Concurrent List) Entries

- (a) 17-A²³ Forests.
- (b) 17-B²⁴ Protection of Wild Animals and Birds.

- (c) 20-Economic and Social Planning.
- (d) 20-A²⁵ Population census and Planning.

1. Legislative Power of State

- (a) State has executive power to make law on the entries contained in List-II.
- (b) It has power to make laws on the entries contained in List III.

2. Legislative Power of Parliament

(a) *Exclusive Power of Parliament*

- (i) Entries contained in List I of VII Schedule.
- (ii) Residuary matters, any subjects contained in any of the three lists for any part of the territory not included in the State.

(b) *It can also make law on any entry contained in State List*

- (i) Legislation in the national interest (Article 249).
- (ii) Legislation during emergency (Article 250).
However, under both the Articles the life of law is for a limited period.
- (iii) Under Article 356.
- (iv) To implement international agreements (Article 253),²⁶
- (v) With the consent of the States (Article 252).

To discharge the constitutional and international²⁷ obligations to check and control the epidemic problem the Parliament of India has enacted the legislation mentioned above.²⁸ The Water Act has been passed with a view to controlling pollution and maintaining or restoring wholesomeness of water.²⁹ Since the Parliament has no power to make such law for the States, Parliament had to resort to the provisions of Article 252.²⁶ Under Article 252 when two or more States pass a resolution that it is desirable that any matter with respect to which Parliament has no power to make laws for the States except as provided in Articles 249 and 250 that it should be regulated by

law, it shall be lawful for the Parliament to make laws with respect to such matters with respect to those States. The law thus made can be adopted by any other State by passing a resolution in accordance with the provisions of clause(i) of Article 252.

Article 252(2) provides that any Act so passed by Parliament may be amended or repealed by an Act of Parliament if a resolution is passed or adopted in the like manner.³⁰ In fact the words 'like manner' are of utmost importance because they indicate that when such law is to be amended or repealed at least two States who have adopted the Act should pass resolution that such Act be amended or repealed. Thus an anomaly comes to the fore, that when the law is amended, the amendment is applicable in only these States which have passed the resolutions for the amendment and not to other States. The purpose of making the law by Parliament is to have uniform law. But the uniformity is lost till the amendment is adopted by all those States who have passed the resolution or adopted the Act subsequently. Therefore, the very purpose of vesting this power in Parliament is frustrated. It is submitted that in order to avoid this anomaly Parliament should make the law under Article 253 instead of shifting the subject of "Water" from List-II to List-III as it would entail a constitutional amendment.

Air Act

India being a signatory to the U.N. Conference on Human Environment held in Stockholm (Sweden) June 1972³¹ where the participants decided to take appropriate steps for the prevention and control of air pollution. The Parliament of India enacted the Air Act to abate the air pollution and preserve the quality of air.³²

The Control Board for the Prevention and Control of Pollution constituted under the Water Act³⁴ shall exercise the powers and functions of the Central Board³⁵ for the prevention and control of air pollution under the Air Act. Similarly State Boards for the Prevention and Control of Water Pollution³⁶ shall be deemed to be the State Boards for the Prevention and Control of Air Pollution under the Air Act.³⁷

The Government of Punjab by Notification has framed rules under the Air Act.³⁸ The rules have been further amended³⁹ where it has been declared that the areas bounded by the respective boundaries of the industries specified in the Schedule appended to the Air Act and located within the State of Punjab are hereby declared as air pollution control areas under subsection(1) of Section 19 of the Air Act. The Board has identified air polluting industries in the State and has laid down emission standards for industries. Accordingly all the industries specified in the list are now required to apply for grant of consent by the Board on or before July 19, 1984.⁴⁰

ENFORCEMENT AND MANAGEMENT

The Water Act as adopted by the State of Punjab applies to the whole of the State. However, the Government is empowered after consultation with or on the recommendation of the State Board, to declare that the Act need not apply to the entire State. Whereas the Air Act as adopted by the States provides that the States shall decide the manner and procedure to declare the area or areas as Air Pollution Control Areas. Thus provisions of the Air Act seems to be more appropriate as it is better to declare the area or areas as Air Pollution Control Areas. Thus the Board can concentrate on prevention control and abatement of pollution in these areas only rather than tackling the problem in the whole of State at the very outset.

LACUNAE IN THE ENFORCEMENT AND MANAGEMENT

Water and air pollution is comparatively a new phenomena for the industry. Till the seventies there was hardly any awareness about this subject and the consequential damage to life whether human, aquatic, animal or plant. The industry paid scant attention to the measures required to check pollution. They never made provisions in their projects and feasibility reports for the land and the funds required for installation of treatment plant. There was no question of their looking into the ways and means to improve the house keeping, to provide

for recovery and or recycling of effluents, or to provide for treatment plants to bring down the pollutants in their trade effluents to the level which would not be dangerous to various types of life.

Therefore, it was neither desirable nor possible to force the industry to take or adopt appropriate measures to control the pollution overnight. The Board has, therefore, adopted a policy of 'Persuasion rather than prosecution'. The Pollution Control Board after coming into existence in 1975 began the exercise of identifying the industry causing pollution and upto December 15, 1986 it had identified 4211 industries.⁴² However, till that date only 1407 industries have applied for grant of consent of the Board and Board has granted the consent as under :

- (a) 577 Industries were granted consent on the condition that the industries will put up treatment plant or improve their house keeping to bring down the pollutants in the trade effluent within the tolerable limits prescribed by the Board.
- (b) 327 industries were granted consent on the condition that they will get sewer connection and discharge their trade effluent into the sewer.
- (c) 181 industries were granted consent on the condition that they will utilise the effluent on land for irrigation purposes.
- (d) 322 industries were granted consent by the Board without any condition as their trade effluents were not of the polluting nature.

It is abundantly clear from the above that the industry has not come out strongly to comply with the Act and take appropriate steps and measures to check and control the pollution.⁴³

Lack of Co-operation from the Industry

The industry feels that the compliance with laws of water pollution control is an unnecessary burden on them. They even hesitate to apply for grant of consent of the Board as it might cause financial and technological stress on them ; whenever

they apply for grant of consent, the Board imposes conditions such as improving their house keeping, treating the trade effluents and discharging them in an appropriate manner. The industry may go to any length to ignore those conditions on various grounds such as absence of technology for treatment, non-availability of land, lack of funds and absence of proper disposal points. Further where the industry installs the treatment plant they try to evade its proper operation in order to save the unproductive expenses on the running of the plant. The Board is presently not in a position to monitor the pollution caused by the industry more than once a year. The industry, therefore, often succeeds to circumvent the provisions of law by resorting to various ways and means.

To begin with the officers and officials of the Board used to visit the industry for the purpose of identifying and quantifying the pollution caused by the industry, to educate the industry about the provisions of the Water Act, and to advise about the procedure for applying for grant of consent including filling of the form for the said purposes. But quite frequently the industry instead of welcoming the co-operation from the Board either ignored them or in certain circumstances were even hostile.

Whenever the Board officers and officials visit the industry to inspect and collect sample of treated and untreated effluents they are quite often made to wait at the gate of the industry till the industry makes arrangement either to close the process causing pollution or to commission the treatment plant. In extreme cases the industry does go to the extent of shutting down the industry itself. Sometimes the connivance of the officers and officials collecting or testing the sample cannot also be ruled out. The Board is, therefore, trying to build up its infrastructure so as to increase the frequency of monitoring to such an interval that the industry cannot adopt any of the above said measures.

Whenever the industry is granted consent subject to some conditions it does not care to comply with those conditions and Board does not possess ways and means to force the industry to comply with conditions except launching prosecution against erring industry. Further the industry does not care to get the consent renewed from the Board until and unless it requires

loan from financial institutions which ask for a clearance certificate from the Board.

To overcome this problem to some extent the Board has been able to obtain co-operation from various organisations in the following respects :

(a) Conversion of Letter of Intent into Licence

The industry department ensures that the letter of intent of Industry is not converted into licence unless the industry obtains no objection certificate from the Board.⁴⁴ In case of medium and large scale industry this responsibility is entrusted to the Directorate General of Technical Development which is a central organisation.

(b) Regional Environmental Engineers on the Siting Board

The industry department has nominated a representative (Environmental Engineer) of the Board on the District Siting Boards to decide location of the Industry.⁴⁵

(c) Withdrawal of Incentives

The industry department has agreed to withdraw incentives like interest from loans from the defaulting industries.

(d) Release of Electric Connection

PSEB has issued instructions that no electric connection shall be released to an industry until it obtains No Objection Certificate from the Board at the time of setting up the industry and a clearance to the effect that industry has installed pollution control equipment before commissioning the industry.⁴⁶

(e) Non-release of Loans by Financial Institutions

The financial institutions do not sanction the financing of a project until there is a proper provision of funds for pollution control and the industry has obtained a NOC from the Board to that effect.

In spite of the measures and all out efforts of the Board and other institutions to ensure that industry takes proper and adequate steps to control pollution, the industry has not come forward to co-operate wholeheartedly rather justifies its non-co-operation on the following grounds :

(a) *Lack of Education* : It is alleged that an average industrialist is hardly aware about the pollution, its existence, causes, remedies and techniques. Therefore, it is inhibited in its approach to tackle the problem seriously. They allege that industry should be properly educated.

Finding some weight in the argument the Board adopted the policy of persuasion rather than prosecution. To educate the industry the Board has been holding meetings with the industrialists from time to time in addition to the individual visits by its officers and officials. The Board also proposes to hold such seminars more frequently. These seminars enable the industry to interact the Board and the experts in this field not only in technological aspect but also regarding the legal aspect of the environmental laws.

To bring more awareness the Board is arranging audio-visual film shows through T.V. and Public Relations Department. Also from time to time officers of the Board have been giving talks on radio and T.V. and this process will continue. In this regard the Universities are also rendering Yeoman's service.

(b) *Disposal of Trade Effluents* : The State of Punjab is a land locked area. Therefore, it does not possess the facility of discharging its trade effluent directly into the ocean. A few rivers that the State of Punjab has hardly have any flow in them as they have been dammed and most of their water has been diverted into canals for irrigation, etc. Thus the rivers can hardly be used as the disposal points for discharging the trade effluents from the industry.

The canals in turn are used in addition to irrigation as a source of raw water for the rural and urban water supply schemes. As such the Punjab Government has decided that no industry should be allowed to discharge its trade effluent into canals even after treatment because even a short failure of treatment plant can cause havoc.

In view of the above existing situation the industry is left.

with two alternative either to use the trade effluents on land for irrigation purposes or recirculate after suitable treatment. In this context the research in these two aspects become inevitable. The Board is, therefore, ready and striving to sponsor the research in this regard.

(c) *Non-availability of Land for Treatment Plants* : The existing industry is mostly situated in congested and thickly populated areas. Even the industry situated in planned cities and industrial areas are not provided sufficient land for putting treatment plants. The industry, therefore, is reluctant to put individual treatment plants.

In view of the above situation the industry is pressing that common treatment plants be put up on co-operative basis. Technically it appears to be unattainable unless the treatment plant is only for one type of industry. Such treatment plants installed in India conform this view. In the case of common treatment plant at Pali (Rajasthan).⁴⁷ It has been realised that the treatment plant cannot work properly until every industry either treats or recovers the pollutants peculiar to it.

Board may not have any objection in granting its consent in installing a common treatment plant if it functions properly. But it is apprehended that the industry is advocating the setting up of common treatment plant as delaying tactics and avoid installation of individual treatment plants.

(d) *Provision of Sewage* : In certain cities and industrial areas sewerage has not been laid and where laid there is no proper disposal of the sewage and the industry find it difficult to get sewer connections. The Board is pressing the Municipal Corporations/Committees and other concerned authorities to lay sewers where industry is existing or is being set up.

(e) *Domestic Effluents* : The industry alleges discrimination that the Municipal Corporations who contributes to the tune of 80 per cent water pollution is not being forced/prosecuted to comply with law.

The grievance of the industry is quite genuine and steps are being taken to put an end to this grievance. Now the Board is equally determined to force Municipal Corporations to comply with the provisions of Water Act. One reason with the Board for being more lax towards the Municipal Corporations/Committees was that these are virtually governmental organi-

sations and do not have adequate funds of their own. But now the Board has reached such a point of time when putting up of treatment plant can no longer be postponed as otherwise environmental problem in these towns and peripheral areas will become unmanageable. They too have to find funds on priority. At the same time the Boards are also trying at the Central Government level that the Planning Commission should allocate adequate funds to the Department of Environment so that it may offer grants-in-aid to these Municipal Corporations and Committees which are ready to put up treatment plants or the funds for treatment plants should be directly ear-marked while allocating funds under public Health Sanitation.

On persistent efforts of the Board twenty two major Municipal Corporations/Committees/Local Bodies have applied for grant of consent by the Board.⁴⁸ The Board is imposing equally strict conditions while granting the consent. The Board has launched prosecutions against ten Committees who have shown complete indifference towards the provisions of the Water Act.

(f) *Standards for Trade Effluents* : The Indian Standards Institute (ISI) is the only body at National level to lay down standards in all fields of production and commerce in the country. Laying down of standards is a difficult task and requires consultation with experts and the affected interests. The ISI has a water Sectional Committee consisting of the Chairman, Central Board for the Prevention and Control of Water Pollution and about 33 other members representing various institutions and industries. There is also a water and effluents sub-committee constituted on similar lines. The Boards are by and large adopting ISI Standards as laying down its own standards would mean duplicating the whole exercise. Also it would involve lot of finances and time. However, the industry is insisting that the Boards should adopt their own standards which may mean relaxing of the standards and postponing the implementation of the provisions of the anti-pollution laws. Any industry which confronts any special problem it should approach the Board for special consideration.

(g) *Shortage of Power* : Whenever there is a break down or cut in power supply the treatment plants are the first causality. The industry is demanding special sanction of load for running

the treatment plants, and that the treatment plant should be exempted from the power cuts by the Punjab State Electricity Board. The Board fully endorses the demand of the industry yet it feels that the industry can still run these plants if it distributes the cut proportionately. PSEB is also sanctioning special load for pollution control equipment.

(h) *Technical and Expert Cells*: The industry has been requesting that the Board should create technical and expert cells to advise the industry regarding the treatment plants. Also the Board should prepare a list of consultants.

The Boards on their part are constrained from offering design of treatment plants because the Boards are basically regulating agencies and cannot act as consultants. They are trying to act as catalyst between the industry and the consultants and between industry and industry, so as to apprise the industry of various methods of prevention, control and abatement of pollution either available with the consultants or being practised by the industry elsewhere. As far as availability of research in cheap type of treatment plants is concerned the Board is approaching a number of consultants to obtain such treatment methods or persuade them to conduct research. The Board is also thinking of financing such research specially in the fields of tanneries, electroplating, dyeing and heat treatment units. As the major part of the industry in these fields predominantly consists of small units and may not be financially sound to undertake such a costly venture.

The main problem with existing industry is that the cost of providing the treatment plant is very high in proportion to the original capital cost of the industry. But this should not be an obsession with the industry. This is only due to time lag otherwise the cost of treatment plant for new industry is quite reasonable being nearly 3 per cent of the capital cost of the project and the industry should be ready to incur such cost towards the social responsibility of utmost importance.

Realising the difficulty of industry, the Government has extended its co-operation for the accomplishment of this stupendous task in the form of incentives to the industry.

(a) The industry department of Punjab is providing assistance to industrial units for getting feasibility/project reports prepared

for treatment and for installation of effluent treatment plants in the industrial units as under :

- (i) Subsidy for the preparation of feasibility/Project reports will be 50 per cent of the cost or Rs. 2,500/- whichever is less.
- (ii) Subsidy for installation/purchase of equipment/machinery for treatment/testing of effluents will be 50 per cent on the total cost or Rs. 10,000, whichever is less.

It is surprising that no industry has so far availed of this opportunity.

(b) The Water (Prevention and Control of Pollution) Cess Rules 1978⁵⁰ provide that where a consumer installs any plant for the treatment of trade effluents, such consumer shall be entitled to rebate under section 7⁵¹ on and from the expiry of fifteen days before the date on which such plant is successfully commissioned and so long as it functions successfully.

(c) *Incentives Under the Income Tax Act, 1961*

(i) The admissible depreciation allowance on machinery and devices at the rate of 15 per cent⁵² but if used to minimise the environmental pollution it is 30 per cent.⁵³

(ii) Where any assessee installs a new machinery or plant after 31.5.1983 which would assist in control of pollution and production of environment is entitled to investment allowance at the rate of 35 per cent of the cost of plant and machinery.⁵⁴

(iii) Any assessee making donation to associations which carry out the programme of conservation of natural resources is entitled to the deduction in the computations of taxable profits.⁵⁵

Prosecution

The Water Act provides for penalties for contravention of the provisions of Sections 24, 25 and 26 under Sections 43 and 44 and the offences by companies and Governmental agencies under Sections 47 and 48. Since the constitution of the Board till August 1983, only 16 cases were filed for violation of the

said provisions of the Water Act. Keeping in view the fact that the industry has been given more than seven years to prepare itself to abide by the provisions of law and its poor response, the Board realised that the desired objective may not be achieved by more persuasion. Therefore, the Board decided to step up the prosecution and as a result it has launched 155 more prosecutions since then and has approved the prosecution of 81 more industries. It has obtained conviction in 13 cases and 32 cases were withdrawn as the industry had complied with the consent conditions.

Under Section 32 the Board has the Power to issue orders immediately restraining or prohibiting the person concerned from discharging any poisonous, noxious or polluting matter into long, stream or well. Under Section 33 the Board can approach the Court of Law for getting injunction against such pollution.

However, a private individual may also go to the Court of Law with the prior consent of the Board for the removal of water pollution.⁵⁶ But a person aggrieved of any kind of pollution need not depend on the recent legislation pertaining to air and water pollution. The provisions are already there for abatement of every kind of pollution. Where any public authority is neglecting a constitutional or a statutory duty resulting pollution, these can be restrained through a writ or a civil suit. The outstanding example of judicial activism in this respect is Ratlam Municipality case where Justice Krishna Iyer has commented that:

"Had the Municipal Council and its Executive Officers spent half this litigative zeal on cleaning up the street and constructing the drains by rousing the peoples' *'Sramdan'* resources and laying out the city's limited financial resources, the people's needs might have been largely met long ago."⁵⁷

By virtue of Article 372 (1) the Common Law originally introduced into India by the Britishers still continues to apply unless it has been modified. Decision in the Raylands case is the living example which lays down a rule of strict liability.

"That if a person creates danger by bringing into or collecting on his land anything likely to be dangerous if it escapes, he must keep it in at his peril."⁵⁸

The remedies under the existing statutes of which two are very important under Section 133 Cr. P.C. and Section 99 (1). C.P.C. where the AG or two or more persons with the permission of AG may go to the Court of Law for declaration or injunction against pollution.

Locus of Public

Keeping in view the provisions of Article 51-A (g) the involvement of public and its active participation in the implementation of environmental programme is a must. Moreover, it is not necessary that the public property or environment should be owned in legal terms by the public which is dedicated to the use of the public is public property. Therefore, it becomes the right of people to protect its own interest. Under Michigan Environmental Protection Act, 1970 any person can approach the court to stop any other person adversely affecting the environment. In the U.S.A. various bodies of persons are acting towards the protection of environment complaining of an injury to the public interest. A District Court in California has remarked "NEPA (National Environmental Policy Act) provides a means by which ultimate owners of the land—the citizen—may inform their trustees—the Government of their approval of the proposed action."⁵⁹

In India also courts have recognised the right of the public to go to the court of law.⁶⁰

The Water (Prevention & Control of Pollution) Act, 1974 like any other piece of legislation is not free from defects. Even the amendment carried in the year of 1978 could not plug all the loopholes. Again number of amendments⁶¹ have been proposed to overcome the shortcomings. It is still in its infancy, however, some shortcomings have been noticed and are being studied and examined by the Boards.

All these efforts to improve the environment are not only to prolong life but also to enhance the quality of life.

"In small proportions we just beauties see,
and in short measures, life may perfect be."⁶²

References

1. The world is too much with us "Flights of fancy" Punjabi University, Patiala, 3rd Edition, 1978, p. 4.
2. Times of India, Tuesday, March 27, 1984, p. 20.
3. *Ratlam Municipality V. Virchi*, AIR. 1980 S.C. 1622.
4. Some voluntary organisations in Kerala, Environmental Health Brigade, World Wildlife Fund, Society for Protection of environment, Society of Environmental Education etc.
5. Universities are organising seminars.
6. Act No. 6 of 1974, to be called as Water Act.
7. Act No. 14 of 1981, to be called as Air Act.
8. Act No. 36 of 1977.
9. Act No. 53 of 1972.
10. Act No. 29 of 1986.
11. See the Constitution (Forty-Second Amendment) Act, 1976.
12. *Ibid.*, Section 2 (a).
13. All the three organs take oath in the name of the constitution.
14. Supra Note 10, Section 7.
15. (1973) 4 SCC 225.
16. *A.K. Gopalan V. State of Madras*, AIR 1950 SC. 27 and *Kharak Singh V. State of Uttar Pradesh* AIR, 1963 SC. 1295. The Supreme Court has laid down that Article 21 deal with all those liberties of a person which were not provided by any provision of Article 19.
17. Article 25 "Subject to public order, morality and health and to other provisions of this part, all persons are equally entitled to freedom of conscience and the right freely to profess, practice and propagate religion."
18. Article 26 "Subject to public order, morality and health every religious denomination or any section thereof shall have the right."
19. Article 31 has been deleted by Section 6 of the Constitution (Forty Forth Amendment) Act, 1978.
20. Supra Note 11. Section 10.
21. *Ibid.*, inserted by Section 11 which introduced a new Chapter IV.A.
22. See. Articles 246 and 248.
23. *Ibid.*, Section 57 (c) (ii) originally the subject of 'Forest' was included in List-II, Entry 19. It was transferred to List-III as the States did not follow a uniform policy for the protection of forests).
24. *Ibid.*, (originally the subject of 'protection of wild Animals' and Birds, was contained in List.II, Entry-20).
25. *Ibid.*, Section 57 (c) (iii). It is a new entry not included in any of the three lists earlier.
26. Sometimes the distribution of powers between the States and Union proves to be a stumbling block in the matters of implementation of international agreements. Therefore, it becomes expedient to vest power in the National Legislature to make law. In Canada out of 44

draft convention scheduled by ILO only four have been implemented
See AG for Canada V.A.G. Ontario (1973) AC—326.

27. India is practically a signatory to all international conferences and conventions on environment.
28. See, Supra Notes 6 to 10.
29. See, Preamble to Water Act.
30. "Any Act so passed by Parliament may be amended or repealed by an Act of Parliament passed or adopted in like manner but shall not as respects any State to which it applies, be amended, or repealed by an Act of the legislature of that State."
31. It was attended by 113 World Governments. India was represented by its Prime Minister, Mrs. Indira Gandhi who also addressed the Conference.
32. Supra Note 7, It was published in the Gazette of India Extraordinary Part-II, Section-I, No. II dated 30th March, 1981.
33. Supra Note 7, Preamble.
34. Supra Note 6, Section 3.
35. Supra Note 7, Section 3.
36. Supra Note 6, Section 4.
37. Supra Note 6, Section 4.
38. Supra Note 7, Section 19.
39. Punjab Government Gazette, Notification No. GSR. 43/CA-14/81/Ser. and 54 (1) 84 dated April 20, 1984.
40. *Ibid.*
41. Supra Note 6. Section 19.
42. Punjab Government Gazette (Ex) dated the 28th March, 1980 Notification No. S.O. 19/C.A. 6/74/S. 26/80 dated 27th March, 1980. By the end of 1979 the Board had identified 1440 industries and notified that all the concerned industries should apply for consent by 30.6.1980.
43. Upto December 15, 1986, 63 industries have installed ETP, 125 industries have improved their house keeping, 211 industries have got sewer connections and 78 industries are utilising the effluents on land for irrigation purposes.
44. Government of India, Ministry of Industry, Deptt. of Industry. Press Note No. 9 (1984) series No. 10/60/83-LP, dated 21st June, 1984.
45. Pb. Govt. Deptt. of Industries letter No. PA/SI/84/3038-3039 dt. 4.4.84.
46. Chief Engineering Commercial (PSEB) Circular No. 17/85 dt. 23.2.85 and Circular No. 12/86 dt. 30. 1. 1986.
47. In Punjab PSIDC on persuasion by the industry in Mohali is looking into the feasibility of putting up a common treatment plant. However, nothing tangible has come out even though more than two and a half years have passed.
48. There are three corporations, five municipalities, ten Notified Areas, four cantonment Boards, three universities in the State of Punjab.

But so far the Board has granted consent to all the Corporations, six municipalities (Class-A), seven municipalities (Class-B), four municipalities (Class-C), RTP (PSEB) & Guru Nanak Dev University Amritsar.

49. Gazette of India Extraordinary, Part-II, Sec. 3 Sub-Section (ii) No. 85 New Delhi, 23-2-1983, vide this notification tax incentives have been provided for machinery and plant for air pollution control equipment.
50. Rule 6.
51. Supra Note 8.
52. Indian Income Tax Act, 1961, Section 32.
53. Income Tax Rules, Appendix-I, Rule (108)
54. *Ibid.*, Section 32-A. (2C), Inserted by Finance Act, 1983.
55. *Ibid.*, Section 35 CCB.
56. Under Section 19 (b) of EPA (1986) any person can go to the court after serving a not less than 60 days notice to the concerned authority.
57. *Ratlam Municipality V. Virdhi Chand* AIR, 1980, SC. 1922, p. 1624
58. (1866) L.R. Ex. 265.
59. *California V. Bergland*, 13 ERC 2245 (1979).
60. *Fertilizer Corporation Kamgar Union V. UDI*. AIR. 1981. S.C. 344.
61. The Water (Prevention & Control of Pollution) Amendment Bill, 1983, and Water (Prevention & Control of Pollution) Amendment Bill 1984 prevented by the authors of this paper at National Seminar on "law towards Environmental Protection" held at Law Department, Panjab University, Chandigarh, (Feb. 10, 11 and 12, (1984).
62. Ben Jonson "The Noble Nature" wings of posy, Punjabi University.



Noise Pollution : Some Legal Perspectives

RANBIR SINGH*

Introduction

The concern of the government for providing clean environment through environmental management, policing and planning has been very deep and sincere since 1970s. This is very clear from the national Plan documents. The management of environmental despoliation was for the first time expressly provided in the Fourth Five-Year Plan (1969-74). This plan highlighted the environmental issues in the following words :¹

“It is an obligation of each generation to maintain the productive capacity of land, air, water, and wild life in a manner which leaves its successors some choice in the creation of a healthy environment. The physical environment is a dynamic, complex and interconnected system in which and action in one part affects others. There is also the interdependence of living things and their relationships with land, air and water. Planning for harmonious development recognizes its unity of nature and man. Such planning is possible only on the basis of a comprehensive appraisal of environmental issues particularly economic and ecological. There are instances in which timely, specialised advice on environmental aspects could have helped in project design and in averting subsequent adverse effects on the environment, leading to loss of invested resources. It is necessary, there-

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fore, to introduce the environmental aspect into our planning and development. Along with effective conservation and rational use of natural resources, protection and improvement of human environment is vital for national well-being."

Since then the environmental matters have assumed significance and the Sixth five-year plan (1980-1985) also attached importance to the subject of environmental conservation and control. Perceiving the problems of environment and its impact on national development, environmental management has come to occupy a place of priority at the hands of government. That the government is seized of the matter is clear from the fact that now a separate Department of Environment (DOE) has been created to tackle the ecological crisis and problems. Some States too have also set up their own department of environment.

This Chapter is an attempt to deal with, only 'Noise' pollution and its effects and legal control.

Noise is a type of atmospheric pollution. It is a shadowy public enemy whose growing menace has increased in the modern age of industrialization and technological advancement. Although a soft rhythmic sound in the form of music and dance stimulates brain activities, removes boredom and fatigue, but its excessiveness may prove detrimental to living things. Researches have proved that a loud noise during peak marketing hours creates tiredness, irritation and impairs brain activities so as to reduce thinking and working abilities. Noise pollution was previously confined to a few special areas like factory or mill, but today it engulfs every nook and corner of the globe, reaching its peak in urban areas. Industries, automobiles, rail engines, aeroplanes, radios, loudspeakers, taperecorders, lottery ticket sellers, hawkers, etc. are the main ear contaminants of the city area and its market place. The regular rattling of engines and intermittent blowing of horns emanating from the caravan of automobiles do not allow us to have any respite from irritant noise even in suburban zones.² However, the noise pollution's most apparent victims today are the residents of neighbourhood near larger airports. The introduction of jet planes have considerably increased their misery.³

Sound and Noise

Sound is the form of energy giving the sensation of hearing and is produced by longitudinal mechanical waves in matter including solid, liquid and gas and transmitted by oscillation of atoms and molecules of matter.⁴ Noise is an unwanted sound without agreeable musical quality. Thus otherwise sound and noise can be taken to mean the same thing, but in considering our acoustic environment, we must differentiate between these two terms. It is only when the effects of a sound are undesirable that it may be termed as noise. Encyclopaedia Britannica defines :

In acoustics noise is defined as any undesired sound. According to this definition, a sound of church bells may be music to others. Usually, noise is a mixture of many tones combined in a non-musical manner.⁵

Encyclopaedia Americana defines it as :

Noise by definition is unwanted sound: What is pleasant to some ears may be extremely unpleasant to others, depending on a number of psychological factors. The sweetest music, if it disturbs a person who is trying to concentrate or to sleep, is a noise to him, just as the sound of a pneumatic riveting hammer is noise to nearly everyone. In other words, any sound may be noise if circumstances cause it to be disturbing.⁶

Pollution from a legal point of view, is generally speaking, the wrongful contamination of the atmosphere, or of water, or of soil, to the material injury of the right of an individual.⁷ Thus noise as pollutant produces contaminated environment which becomes a nuisance and affects the health of a person, his activities and mental abilities. So noise pollution is unwanted sound 'dumped' into the atmosphere notwithstanding the adverse effects it may have on living and non-living things.

The scientific community has already accumulated considerable knowledge concerning noise, its effects and its abatement and control. Noise control also has a long history. The Romans, perhaps, enacted the first prohibitory noise law when, by a popular decree, chariots were banned from the streets at night.⁸

Sources of Noise

Sources of noise are numerous but may be broadly classified as :

- (a) Industrial ; and
- (b) Non-industrial.

The industrial may include noises from various industries operating in cities, like, transportation, vehicular movements such as car, motor, truck, train, tempo, motor cycle, aircrafts, rockets, defence equipments, explosions, etc. Among the non-industrial sources, important ones are the street noise due to hawkers, use of loudspeakers, thunder, demonstrations etc. However, the list is not exhaustive as the number is on the increase with the industrial and technological advancement. The effects of some booms that would follow the supersonic transport, if it is put into practice is a cause of concern.⁹

Noise levels are measured in decibels. One decibel is the threshold of hearing. 30 decibels denotes the whispering range, 50-55 decibels may delay or interfere with sleep, 60 decibels is the level of normal talk ; 90-95 decibel may cause irreversible changes in the automatic nervous system ; 150-160 decibels prove fatal to some animals.¹⁰ The values of noise quantum of some of the cities in our country indicate their pitch in decibel in the noisest areas of corresponding cities *viz.*, Delhi (89), Calcutta (87), Bombay (85), Madras (89), Cochin (80), Madurai (75), etc.¹¹ The noise level is self explanatory of the alarming situation in big cities. Situation though is not so alarming in small cities but nonetheless, it is getting worse if timely curb is not planned. The trauma of noise pollution may prove fatal.

Noise researchers say that noise levels in excess of 90 decibels (unit for measuring noise intensity) for continuous periods can cause loss of hearing. A single exposure of 150 decibels is known to cause permanent injury to the ear's internal mechanism. In cities like Bombay, Calcutta and Delhi, the average noise level has been found to be between 65 and 90 decibels. The effect of environmental noise on the foetal develop-

ment during pregnancy has been the subject of research. It is found that constant exposure to noise between 110 and 120 decibels can produce narrowing of vision, vertigo and disruption of equilibrium in the unborn baby. The noise level doubles every six years, taking its toll of our hearing. By 2000 A.D. it is possible that no one above age ten will hear normally.¹²

One of the common factors creating noise pollution is indiscriminate use of loudspeakers. In India no function or ceremony is complete without a loudspeaker which has all characteristics of a new specie of public nuisance. The recent spate in '*Jagrans*' and '*Jagrans*' and completion of these religious ceremonies in temple or private, which go on for whole nights, marks the unabated use of loudspeaker without a moments pause. The situation at the time of Ram Lilas or electroneering is much more shocking. One is forced to hear the discourses whether one likes it or not. Most people bear it and are reluctant to lodge a complaint for fear of unpleasant neighbourhood relations and fear of bringing the wrath of the users on them. Is this competitive religious fervour from every place of worship necessary ? Is it not tortureous for a person who wants to rest and sleep, for a student who wants to study ? The agony of a patient in such situation is beyond imagination.

Effects of Noise

Noise has many ill effects on living as well as non-living things. Its general effect on human beings is that it causes disturbances in sleep which lead to other side effects. It has auditory effects like loss of hearing. Broadly speaking it has :

- (a) Psychological ; and
- (b) Physiological effects on living things

Psychological

Many behavioural changes are recorded as a result of exposure to high level noise in human beings as well in animals. Certain symptoms can be observed outrightly. The undesired sound may cause annoyance. Intolerable agony may result when

the source of the sound is not known. Interruptions in speech communications may impair performance, lead to errors and lower output and efficiency. Noise can cause tension in muscles, nervous irritability and strain. No doubt the noise reaction varies to large extent in different individuals.¹³

Physiological

Noise produces physiological effects on human body. Several birds have been observed to have stopped laying eggs.¹⁴ Apart from this the animals change their places. There is a decrease in migratory birds to a place if it is subject to noise. Prolonged chronic noise can also produce stomach ulcers as it may reduce the flow of gastric juice and change its acidity. It may lead to abortions and other congenital defects in unborn children.¹⁵

Effects on Non-living Thing

The high intensity of noise effects non-living things too, viz., buildings. The cracks in the city of the Recoco Church at stem-hausan were caused by some booms.¹⁶

We can all narrate our experiences of the effects of noise. However, its interference with speech and sleep and the depreciation of the value of property for residential purpose near airports, and other noise prone areas is well known. Apart from this, people living in noisy areas may develop habit of shouting and even deafness. Aircraft noise can be the 'last straw' before onset of psychiatric disorders.¹⁷ There is a need to do medical research in India on effects of noise, so that its impact on human beings is well characterized and proved. Thus the effects of noise are of concern for human beings, wild life and non-livings.

Legal Control of Noise

Pollutions are writ large on the fields, factories and facets of all forms of life. These are destroying the ecosystem and consuming the qualities of environment.¹⁸ Hence there is a growing need to regulate pollutions through law, so that the

environment is saved from being polluted beyond repair, in the interest of mankind.

Many countries have enacted specific legislations to control noise pollution, for example England and America. In England there is Noise Abatement Act, 1960, of which Section 2 provides that loudspeakers shall not be operated (a) between the hours of nine in the evening and eight in the following morning for any purpose ; (b) at any other time for purpose of advertising and entertainment, trade or business. There are exceptions of course prescribed in the act.¹⁹

The US, Noise Pollution and Abatement Act, 1970 is an important legislation for regulating control and abatement of noise. Under this law the environmental protection Agency, acting through the office of Noise Abatement and Control, holds public meetings in selected cities to compile information on the noise pollution. In some US States, environmental rights have been embodied in their constitution.²⁰ As early as 1948, in *Charles Kovacs V. Albert Cooper*,²¹ 'A city ordinance prohibiting the operation upon the streets of sound amplifiers or other instruments which emit loud and raucous noise' and are attached to vehicles operated or standing upon such streets was challenged. A conviction for a violation of this ordinance, affirmed by the State appellate courts, was further affirmed by a majority of the Supreme Court of the United States as against the objections that the ordinance is lacking in definiteness and that it infringes upon the constitutional right of free speech. The majority agreed that sound amplification in streets and public places is subject to reasonable regulation, and least, did not disagree that an ordinance prohibiting the emission of 'loud and raucous noises' does not go beyond reasonable regulation. Even in Japan there is acute awareness about environmental management under the Anti-Pollution Basic Law.²² Even a small country, like Israel, has taken initiative by enacting legislation to control anti-pollution activities.²³

In India it is important to note that there is no law which exclusively deals with problems of noise and its control. Though the Indian Constitution embodies provisions in Articles 39 (e), 47, 48-A and 51-A(g). Article 39(e) states that the health and strength of workers, men and women, and the tender age of children are not abused. Article 47 enjoins upon the State

to raise the level of nutrition and the standard of living and to improve public health. Since 1976 Article 48-A provides :

The State shall endeavour to protect and improve the environment and to safeguard the forest and wild life of the country.

Article 51A(g) reads :

To protect and improve the neutral environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.

There are other micro provisions and enactments regulating loudspeakers in the States of M.P., Rajasthan and Bihar.²⁴ Section 3 of the Bihar Act provides restrictions against use and play of loudspeakers. It reads :

No person shall use and play a loudspeaker

- (a) Within such distance as may be prescribed from a hospital, a building in which there is telephone exchange; or
- (b) within such distance as may be prescribed from any educational institution maintained, managed, recognised or controlled by the State Government, or University established under any law for the time being in force, or a local authority, or admitted to such university, or any hostel maintained, managed or recognised by such institution when such institution or hostel is in the use of students.

Section 6 provides that the cognizance of offence under the Act would be on a complaint made by, or at the instance of, the person aggrieved by such offence or upon a report in writing made by any police officer. Apart from this the Indian Penal Code also has provisions to regulate pollution on the ground of nuisance.²⁵ Suits can be filed under law of torts too but it is marred by delay and for want of money. The Motor Vehicles Act, 1939, also provides certain restrictions on trucks regarding noise by use of horns.²⁶ Krishna Iyer J. rightly says :

'Local boards Act if democratically implemented, Town Nuisance Acts and the Police Acts, if promptly and punitively used the Criminal Procedure Code and the Indian Penal Code if socially activated and proscriptively popularised, almost all nuisances, widely defined to include pollution on land, contamination of water, noise aggression and noxious discharges into the atmosphere, in short, biosphere molestation, could be interdicted. But environmental protection is not the executive's cup of tea nor that of judiciary.'

Law is too tame to halt the politics of pollution.²⁷ The pity is that at the level of implementation the law is in suspended animation for extraneous reasons.²⁸ Recently a landmark verdict of the Himachal Pradesh High Court shows a ray of hope for the people who have been victims of civic apathy and administrative neglect. It decides through a Public Interest Litigation suit on a significant aspect of the attitude of public functionaries and their duties.²⁹ It said :

"When loudspeakers are allowed to disturb the neighbourhood, it is the duty of the police and the Deputy Commissioner to take appropriate action against those creating a nuisance and not wait for the suffering public to protest to the police."³⁰

The Environmental (Protection) Act, 1986 : One Step Forward, Two Steps Backward : The Environmental Protection Act, 1986 which came into force from 19th November 1986 to commemorate the memory of Mrs. Indira Gandhi, who was globally recognised as a dedicated environmentalist. Her speech at the U.N. Conference on the human environment at stockholm in June, 1972, remains as one of the most important on the relationship between environment and development from the perspectives of underdeveloped nations.

The Act purports to inculcate environmental ethics in every citizen and to take appropriate steps for the protection and improvement. The new Act for the first time attempts to lay down comprehensive law on environment and goes beyond the scope of the water and our pollution Acts passed in 1974 and 1981 respectively. Section 2 of the Act defines environment to include

water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, micro-organism and property. So this definition covers a much broader area than pollution.

But this Act has been likened to a cobra that is seemingly fierce. It raises its hood and hisses menacingly but if you prise its jaws open, you will discover it has no venom in its fangs.³² This is rightly so because it restricts the right of environmentalists to go to court on ecological issues. Under the Act a person cannot directly file a petition in court on questions of environment. One is required to give a notice of not less than 60 days to the Central Government of his intention to make a complaint. One can only go to the court if the Government does not act on the notice of this period. It may be submitted that such provision impede rather than serve the cause of environmental protection. Section 6 of the Act provides rules to regulate environmental pollution, wherein Section 6 (2) (3) provides for the maximum allowable limits of concentration of various environmental pollutions (including noise) for different areas.

Another important feature of the new Act that became law on May 23, is the inclusion of a section on hazardous industries and environmental disasters. A 'hazardous' substance according to the new Act, is 'any substance or preparation which, by reason of its chemical or physio-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plants, micro-organisms, property or environment.'³²

Stringent measures have been provided to check hazardous pollution. Section 8 of the Act states clearly that 'No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed.' And Section 6 (f) empowers the Central Government to make rules for the procedure and safeguards for the prevention of accidents which may cause environmental pollution and for providing remedial measures for such accidents. Moreover, it is now mandatory for a person responsible for the discharge of any hazardous substance in excess of the prescribed norms to immediately inform the concerned authorities and to render all possible assistance. Earlier there was no such responsibility enjoined upon him.³³

The new Act has some drawbacks. For one, all power and authority is vested in the hands of the Central Government. There is no free delegation of powers to the State Governments. Even the authority or authorities constituted to implement the Act are subject to the supervision and control of the Central Government. Excessive centralisation could become a major hurdle for the efficient execution of the provisions of the Act.³⁴

Another drawback is in Section 24(2) of the Act 'where any act or omission constitutes an offence punishable under this Act and also under any other Act when the offender found guilty of such offence shall be liable to be punished under the other Act and not under this Act.' This is an anomaly, as most of the offences committed under the new Act would also constitute offence under the water and Air Acts. And the penalties provided for in these Acts are less stringent than those permitted by the new one. Hence offenders against the common provisions of the Acts, under shelter of section 24(2) of the New Act, would have to be punished according to the earlier Acts, and therefore, would get away with a lighter punishment. This lacuna in the Act needs to be removed at once.³⁵

Yet another apparent drawback pertains to the issue of industrial pollution. Section 6(e) of the Act empowers the Central Government to make 'rules for 'the prohibition, restrictions on the location of industries and the carrying on of processes and operations in different areas.' This is, no doubt, a welcome provision as upto how there were only guidelines issued in this regard.³⁶

What is lacking, however, is a specific mandatory provision for the industry to prepare and submit to the concerned authorities a suitable environmental impact assessment report before the location chosen is approved.³⁷

It may be stressed here that the role of environmentalists and other voluntary bodies instead of being curtailed should have been enhanced under the Act. Public interest litigation cases will suffer a set back under the provisions of the Act. In fact the act has taken one step forward and to step backward. The Act smacks of over centralization of powers in Central

Government which is not conducive to the protection of environment.

This makes abundantly clear that the pathology of legal importance in overcoming pollution is not so much that we have not enough law but most laws with police powers bark but do not bite.³⁸ Public interest litigation with broadened rules of *locus standi* for initiating such actions is the right answer to such pollution problems.³⁹ Environmental litigation as included in public interest litigation is not new, even to India.⁴⁰

Conclusion

What is warranted for is a uniform law for controlling noise pollution so that the society is freed from this hazard. Legislation must envision positive action and not stop with policing the pollution. A notional environmental policy and ecological plan must be promoted by law so that man and nature love and live in harmony.⁴² There is no escape from pollutant. It reaches us through, the air we breath, the water we drink, the food we eat and the sounds we hear. The environmental pollution has many views which warn us. In view of the alarming proportions of noise, and its impact, what is called for, is 'noise control' through technology, determination of administrators, public and judiciary. Because only a healthy environment provides a healthy body and a healthy mind. Man is maker of his own environment, and he should not add to his miseries by himself polluting it. People should be made increasingly aware of the part that natural environment plays in determining the quality of their lives. Participation in environmental protection should be properly championed through local organisations, conservation councils and commissions. Environmental law societies should be encouraged like SOCLEAN (Society for Clean Environment, Bombay) in all parts of the country. Public Interest litigation is the right measure and a positive help by judiciary for curbing noise pollution and for promoting the cause of environmental quality throughout the country. Apart from this, law schools, should include environmental law in the curriculum of the law course so that the law students are acquainted with the problems relating to environmental. Krishna Iyer J. rightly says :

'The Constitution commands us, the law forbids us. Let us by nature's patriots. Regulatory legislation to control environmental pollution is a must since the rule of law must defend the rules of life. And life will survive only if the biosphere is safe. But law is paper tiger unless education makes society militantly aware of the risks of pollution.'⁴³

The biosphere sustains us all. To preserve it is the path to progress. To pollute it is route to ruin—may be today, may be tomorrow.⁴⁴

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An analysis of more than 225,000 births in the Los Angeles area by Dr. Nowell Jones, Professor of Psychology at the University of California, showed that there were more birth defects among babies whose mothers lived near the international airport than those lived in quieter sections.

In a similar study, a high percentage of stillbirths was found in the area near London's Heathrow airport. There is growing evidence to show that exposure to high decibel levels contributes to physical, psychological and behavioural disorders, says Dr. Y.T. Oke, a city physician. Mr. Oke told a Press conference that frequent or continued exposure to noise above 85 decibels as in most large cities, can cause irreversible deafness, mental agitation, violent behaviour, insomnia, and increase the pulse rate blood pressure and cholesterol level.

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Some Issues of Air Pollution in India

SATISH CHANDRA*

Since the 'Second World War' the expansion of industries, the rise and increase in density of the population and general improvement in living standards have proceeded simultaneously. It is undisputed that the growth of industry must necessarily involve more pollution. Pollution is not a series of unrelated problems concerning air, water, the sea, land dereliction and the like. It is a single problem concerning waste, which often may be disposed of in a number of different ways. It is a house keeping problem. Today, it is causing concern and in future it will require serious endeavour of the nation. This will require uniform handling at a national as well as international levels.

Energy Versus Pollution

It is beyond doubt that the pollution is a by-product of energy and necessary evil of the society. The production, distribution and consumption of commodities necessitated the use of space, minerals, metal, fibres, food, air, water, energy and other resources. Finally all production and consumption depend on the use of energy. Energy sources include oil, coal, natural gas and nuclear fission. All energy systems have impacts on the environment resulting from waste associated with the full range of activities incident to the generation of electricity

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and the production and consumption of other goods and services. Even the production and consumption of electricity itself omits toxic waste which may be safely managed or disposed of.

Pollution is everywhere. Both as living in our homes and as members of an industrial and agricultural community, we all produce water waste. If that waste can be disposed of without effecting others, no problem arises. As soon as the disposal does affect others, directly or by the most indirect route, we are faced with a social problem. In India, law has been involved to permit men together peaceably without undue interference. The interferences caused by individuals juridical persons or by their waste products. The following two special statutes have been enacted in India to deal with pollution at National level.

- (a) The Water (Prevention and Control of Pollution) Act, 1974.
- (b) The Air (Prevention and Control of Pollution) Act, 1981.

Social Cancroid of Air Pollution

Pollution of the air differs in some aspects from pollution in waste. Discharge from industrial premises to the atmosphere are often more or less continuous during working hours and they can drift high or low and in any direction, depending on the wind and weather. Pollution of the air is more widespread in its effect than other forms of pollution for people who have to breathe the air. Air pollution creates cancroid not only for the animates but also for the inanimates. World wonder Taj Mahal at Agra is burning example of stone cancer. But immediate effect of air pollution can be seen on human being.

Meaning of Pollution

It involves the introduction into some part of the environment of matter or energy. According to Section 2 of the Air (Prevention and Control of Pollution) Act, 1981, 'Air' pollution means the presence in the atmosphere of any "air" pollutant" which in turn means any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or

tend to be injurious to human beings or other living creatures or plants or property or environment. Pollution damages not only the health of the individual, it rather affects adversely the entire social fibre and leaves it unbridgeable impacts.

The Nature of Air Pollution

Air pollution is as old as industrialisation. In recent years, it has been proved that unseen pollution by chemical agents may be as dangerous as and more invidious than the visible pollution by particles contained in smoke. Scientifically, the nature of air pollution may be divided into two folds viz.,

- (a) Air contain solid, liquid and particles such as dust carbon, hydrocarbons, etc. Which are electrically charged and thus kept in suspensions by electrostatic forces.
- (b) The air contains gases which are poisonous on obnoxious in nature—sulphur dioxide, carbon monoxide, oxides of nitrogen, hydrocarbon vapours and other substances. The most harmful element is benzopyrene.

First fold of the air pollution is created by the mobile source and domestic source. Second type of pollution in the air is due to industries.¹

Effect of Air Pollution

(a) *On Human Being* : It is a universal truth that air pollution has an adverse effect upon the health of human being as well as ecology. Through data collection, it has been proved that people living in pollution areas are suffering from certain diseases² than people living in fresh air. "Cause and effect" relationships have been proved between air pollution and diseases.³

(b) *On Weather* : Emissions into the air that are intended to cause changes in the weather, such as local rainfall, and others that are suspected of causing permanent atmospheric or geophysical changes are of special nature. Quite recently concern has been expressed over the fate of the ozone layer

enclosing the earth and the possible effects on climate and human health should it be depleted.

Sources of Air Pollution

On the basis of nature and effects as well as energy consumption, sources of air pollution may be classified as under :

(a) *Domestic* : This source is the primary source to meet the basic needs of individuals. It includes domestic fire and domestic incineration which is required for cooking and heating. For pollution it is a weak source which creates pollution in the air.

(b) *Mobile* : It contributes pollution in the air specially in metropolitan areas. Mobile source includes road vehicles, air crafts, ships, railways and other combustion engines. Mobile source is a second largest source of air pollution. Today it includes almost all known forms of transportation. With constantly increasing number of vehicles of old types particularly in towns and cities with a hot climate, the problem of air pollution is assuming greater importance.

(c) *Industry* : It is the principal source of air pollution and covers all the units which are engaged in production and consuming energy in any form. It includes coal, oil, natural gas, electricity or nuclear fission. Mainly, the contribution of industries is in the form of "dark Smoke" which includes soot, ash and grit emitted in the smoke. It is "dark" if it appears as shade two or more on the Ringelman chart.⁴ The presence of visible constituents shows that combustion is incomplete, and indicates the presence of pollutants.

Some Remedies for Prevention and Control of Air Pollution

For every problem, "there ought to be a law" "is a cry frequently heard from people outraged at some real or imagined misconduct. But putting a law on the books does not necessarily put it into effect. Of course, the laws are only the beginning. But its effectiveness depends on implementation, interpretation as well as awareness of the people. The steady

accumulation of such public awareness will inevitably catalyze into positive political action not only to gain better protection of the clean air but also to focus on the issues of the compatibility of our market economy⁵ institutions with our finite physical resources base, and the need for modes of production and consumption that use the best available state of the art and latest technology and strive for total recycling and maximum benign energy sources.

No doubt, in India, the problem of air pollution did not attract careful attention of the government in the past. Today, it is a problem not just confined to a particular city but it is national and international problem.⁶ Now a days it is a matter of grave concern and in future it will require a serious thought and endeavours of the nation. This will require uniform and swift handling at the national level instead of each unit attempts in its own way.

The preventive measures on possible suggestions in the light effect of air pollution and its sources the following may be noticed as of common interest.

The government and other agencies should initiate publicity to draw public's attention to the problem of air pollution. The Central Board for Prevention and Control of Pollution should also fulfil its functions and obligations as mentioned in Section 16(2) of the Air (Prevention and Control of Pollution) Act, 1981. The relevant sub-clause is as under Section 16(2) : the Central Board may :

- (f) Organise through mass media a comprehensive programme regarding the prevention, control or abatement of air pollution :

At present, there is no single recognised source of information about pollution. People are interested about their neighbourhood and need reliable and scientific local information about pollution.

Pollution is a national problem. Pollution problem must eventually be solved by the same generalized process through which other issues are solved. No doubt, that there are distinguishing features of pollution problem which result from mixing from technical and political forces. Today, we are facing

pollution crisis which has begun to be translated into positive Governmental action. Governments at all levels have to meet the crisis at hand with shift and far ranging public action. The annual report (1975-76) of the Works and Housing Ministry said that the governments of Tamil Nadu and Nagaland were not interested in adopting the Water Pollution Act, 1974. The Act is still not in force in many States as mentioned in Section 5 of the Air Pollution Act, 1981. It is desirable that all the unit of India will meet pollution crisis at war footing level. Although for the same Section 16 (2) of the Air Pollution Act, 1981 is as under :

The Central Board may :

- (b) Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of air pollution;

At the same time, a flexible system is also desirable to meet varying local conditions.

In India, the energy sources should be increased to meet the emerging demand of the nation. The energy emergencies and construction industry slumps of recent years brought on pre-mature prediction of the death of the pollution movement.

It is submitted that energy sources must be pollutants free by disposing off waste. For this purpose hydro-electric plants, nuclear plants, natural energy sources like sun, tied of sea may be increased. In future these energy producing sources will provide the cheapest and pollutant free fuel.

To meet the pollution problem, sufficient amount is required in the annual budget of the governments. For all the suggested measures heavy amount is needed. Money is required to improve our environment because pollution is directly connected with the energy. Further it is suggested that the Central Board or State Boards may be put under the control of Ministry of Energy.

Control of Air Pollution at Sources

Apart from, the present problem also aims to analyse the concerning legislation which may appear to reveal a transition

from dealing with the effect of air pollution to exercising the control over its causes and sources.

Air pollution by domestic source is a primary one. It includes domestic fire and domestic incineration which is required for cooking and heating. No law is required to control domestic sources of pollution. So it may be suggested to increase the use of smokeless fuel for domestic purposes. Only cheap and smokeless fuel can solve the problem. Further, proper sanitation is also expected in every locality to prevent and control the air pollution.

Air pollution by mobile sources includes road vehicles, air-crafts, ships, railways and other combustion engines. With raising the socio-economic standard, number of vehicles have increased sharply. The causes for the emission of smoke from mobile sources and suggested measures are as under :

(a) *Lead in Petrol* : Petrol used in high compression engines is inevitable and has a lead attraethyl additive to improve its anti-knowck properties. This is exhausted as lead oxides which are highly toxic and harmful. If lead could be eliminated from petrol, the amount of solid matter in the exhaust could be reduced by about 80% and that of unburned hydrocarbons by 30%. Today petrol with a high lead content is essential for high compression engines. Lead free petrol means that compression ratio will have to be lowered, with the effect that power and fuel consumption performance figures will be worsened. In many countries the amount of lead in petrol has been restricted by law. There is also some co-operation in this matter between automobile manufacturers and oil companies of foreign countries.⁸

In India, automobiles are manufactured to run on 1979 to 83 octane petrol which contains 420 to 560 grms lead per kilolitre. In 1984, for Maruti Car and other newly introducing automobiles, the Government of India has an idea to introduce "Super Petrol" 87, 93-97 octane which will contain 900 grms lead per kilolitre.⁹ It is, therefore, suggested that low octane petrol should be used in India. Automobile manufactures should also extend their co-operation by improving technology. Of course, little consumption of petrol will be increased due to less quantity of lead. Let's hope that the government will prefer good health for citizens in comparison to petrol

consumption. It is notable here that Australia has introduced lead free petrol from July 1985.

(b) *Diesel Engines* : Diesel engines in buses and lorries are responsible for much obnoxious pollution. The great part of this is in the form of poly-nuclear hydro carbons, several of which are strongly suspected of causing cancer. Diesel engines often give off very heavy sooty black smoke, which does add appreciably to the air pollution on the roads. But it has been shown by research that if diesel engines are properly adjusted, their exhaust contains far fewer pollutants.¹⁰ The causes for the emission of smoke from diesel engines are:

(i) *Silencers* : More intensive efforts are desirable for introducing regulations on silencers. The object of this would be to make it illegal to fit unsuitable or poor quality silencer systems or those designed to omit an unreasonable amount of noise and carbon-dioxide.

(ii) *Overloading of Engine* : As the applied load begins to exceed the rated power out-put of a given engine, there is a sharp increase in carbon mono-oxide and black smoke emission. There is no reason by a fitment of these should not be compulsory by law.

(iii) *Maintenance of Diesel Engine and Adjustment of Fuel System* : Apart from overloading, poor maintenance of diesel engine, its fuel pump and oil injection systems will lead inevitably to excess pollutants in the exhaust.

India has, however, taken due care to legislate laws regarding the issues at hand. Of these, the Motor Vehicles Act, 1939 may be noted as of the primary significance.

Sections 69 and 70 of the aforesaid Act deal with the construction, equipment and maintenance of motor vehicles, Section 70 sub-clause (2-a) is concerned with the width, height, length and overhang of vehicles and on the loads carried; (h) the emission of smoke, visible vapour, sparks, ashes, grit or oil. Further, Section 124 of the Act says that driving vehicle exceeding permissible weight shall be punishable for a first offence with fine which may extend two hundred rupees, and for a second or subsequent offence with fine which may extend to one thousand rupees.

Rule 116 of the U.P. Motor Vehicles Rules, 1940 also provides, compulsory fittings of silencer in every motor vehicle.

According to Rule 124, there shall not be any smoke, visible vapour, grit, sparks, ashes, cinders or oily substance which might cause damage to other persons or property or endangers the safety of any other users of the road.

Section 20 of the Air (prevention and control of pollution) Act, 1981 is an assurance to the standard for emission of air pollution from automobile. Accordingly, the State government is empowered to give such instructions as may be deemed necessary to the concerned authority incharge of registration of motor vehicles under the Motor Vehicles Act, 1939.

Besides, by the statutory provisions, the suggested remedies among others may be the legal control to stop the vehicle on roads as soon as normal running life of period has been achieved. Further, it is suggested that the State governments should appoint the motor vehicles officers under Section 133-A of the Motor Vehicles Act, 1939. These officers should be recruited exclusively to prevent and control air pollution generated by the heavy vehicles. They should be trained to discharge duties as desired under Sections 20 and 26 of the Air Pollution Act, 1981.

For a regular and careful watch, vehicles ought to be put to regular or occasional checks at selected spots.

The vehicle examiner should be assisted by the police force as an integral part of the programme of spot checking. Since the testing site would be adjacent to the road and the tests itself would not take more than five minutes, there would be little loss of time or inconvenience for those selected and checked.

Besides, above the following are some other suggestions which may be helpful in preventing air pollution due to automobiles.

(a) Some roads should be reserved exclusively for automobile traffic. On the other hand congested roads and lanes etc. should be declared as "automobile traffic control area" under the Air Pollution Act, 1981.

(b) For local purposes, the use of cycles and other smokeless vehicles should be encouraged. China is the best example in this context.

(c) The trolley system as a means for mobility may be an idea which will be helpful to reduce the pressure on roads.

(d) Electric trains and cars may also be helpful to prevent and control air pollution.

Among others air pollution caused by industries is also a chief one. Industry needs energy and all energy sources have pollution by product. Causes for air pollution from industrial sources have already been discussed earlier in the present Chapter. So it would be needless to waste time in discussing the causes. Let us, therefore, come directly to the remedial measures concerning the Air Pollution Act, 1981 and the industrial pollution.

(a) Under the Atomic Energy Act, 1962, Section 2 defines "atomic energy" which means energy released from atomic nuclear as a result of any process and the fissile material means Uranium 233 and 235, Plutonium or any material containing these substances. But no where pollution has been defined except the Air Pollution Act, 1981.

Section 2 of the said Act defines "Air Pollutant" and "Air Pollution" which are confined to only any solid liquid or gaseous substance present in the air. It is suggested that the definition of "air pollution" should cover not only smoke and fumes from factories or automobiles but also cover radiant energy, noise and vibrations.

(b) Under the Air Pollution Act, 1981 and the Water Pollution Act, 1974, there is a common provision for constituting a "Central Board" for the prevention of pollution. Under Section 5 of the Air Pollution Act, the State government, shall appoint and constitute State Boards for the prevention of pollution. But under Section 47 to 49, the State Government is empowered to supersede the Board at any time, also to reconstitute the Board by a fresh notification or appointment.

It is submitted here that these Boards should be independent and beyond the grip of politicians who may be the tools of the owners of the industries. Further, it is submitted that these Boards may be replaced by the "National Environment Protection Authority" (NEPA). The special powers should be conferred to the authority to take emergent measures for, remedying or mitigating atmospheric pollutants and restraining all concern from discharging any polluting material.

(c) The local authorities should also be established and

specially empowered to pass by-laws to prohibit or control emissions from any source of any type of air contaminant.

(d) Section 21(1) of the Air Pollution Act says that no person shall, without the previous consent of the State Board, operate any industrial plant specified in the Schedule in an air pollution control area. The schedule has list for only 20 type of industries. It is submitted that this section should prohibit operation of the all plants in these areas who produce dark smoke regardless of the Schedule.

(e) In the Act a new Schedule is suggested which will prescribe the height of chimneys, permissible measurement of grit, dust and fumes emitted from furnaces of each type of industry. Only after comparison the standard prescribed in the Schedule, the concerning authority should take steps under Sections 28-30 of the Air Pollution Act.

(f) According to Section 31 of the Air Pollution Act, any person aggrieved by an order made by the State Board under this Act, within 30 days on which the order is communicated to him, prefer an appeal to such authority as the State Government may think fit to constitute.

It means that the Board is responsible to inspect (Section 24), collect the sample (Section 26), analyse the samples (Sections 26-29), also award the penalties under (Sections 22, 37) of the Act. Later on only an appeal is allowed before the Appellate Authority. Thus the Board is over burdened with performing executive as well as judicial functions. It is suggested that the Board should confine to the executive function only. Judicial function should be assigned to independent body like labour tribunal or industrial tribunal, etc. In the court the Board's role must be an evidentiary forum for presenting the scientific, socio-economic issues.

(g) Section 43 of the Air Pollution Act states that no court shall take cognizance of any offence under this Act except on a complaint made by, or with the previous sanction in writing of, the State Board, and no court inferior to that of a Metropolitan Magistrate or a Judicial Magistrate of the first class shall try any offence punishable under this Act.

It is suggested that offence under the Act should be made cognizable under Criminal law. The right of filing complaint should also be extended to individual under social action

litigation policy. Individual's complaint may, if nothing else, heighten public ecological consciousness and set up motion political forces that later give an executive action. Victory for any particular party may not be desirable. It may be preferable that a particular policy or project be permitted to proceed, but with certain conditions.

(h) To make the Board a potential agency it must be authorised to consult others competent to regulate, build finance, or aid various projects and programme, such as highways, airports, power plants, housing, agriculture and water resources improvement and other activities involving pollution and environmental protection.

(i) The provisions are desirable to control the types of smokeless fuel to be burnt in the installations where combustion are not otherwise controllable.

(j) Since energy is essential in production and consumption activities, in future only nuclear energy and hydro-electricity plants will provide the cheapest fuel and will be able to solve completely the problem of urban air pollution. The Board must engage in an analysis with energy production and consumption. It must also engage in a systematic balancing analysis at key points in the decision-making process.

(k) To assess the predictions, assumption must be made as to availability and future cost of reprocessing and waste management capacity of nuclear fuel industry.

It summation, it may be submitted that the citizens much have the rights through pollution control Authority, use the litigation process for the protection of air, water and natural resources and to participate more effectively in major government and corporated decision making process.

It is a pious hope that the government will assess economic and technical benefit and weigh them against pollution costs.

References

1. The Air (Prevention and Control of Pollution) Act, 1981 was enacted by the Government of India to implement the decisions taken at the U.N. Conference on the Human Environment held in Stockholm in June 1972, in which India participated.
2. Diseases due to air pollution are : Bronchitis, Myocardial, Pneumonia, Corohery, Lung Cancer, Vascular lesions of the nervous system, etc.

3. Solar radiation is much reduced and in consequence, plant growth in a polluted area is stunted. Acidity of rain water and the deposition of solids are other effects of air pollution.
4. Ringelman Chart, please see detail :
R.M.E. Diamant, *The Prevention of Pollution* (1974), p. 196.
5. For effect on pollution on national economy, please see :—
David F. Poulson, *Pollution and Public Policy* (1973), p. 1.
6. For international aspects, please see :
James Dorrer, *The International Law of Pollution* (1974).
7. Diamant, *op. cit.*, 196.
8. For example, 90 per cent of all Ford Motor Cars made in USA are designed to run on 91 Octane lead free petrol.
9. "Dharam Yug" (Hindi weekly), 8th January, 1984.
10. *Ibid.*

Judicial Approach to Environmental Law

M.K. AGRAWAL*

Mankind is the creation of nature. But man under the pretext of conquest of nature, is sowing the seeds of destruction of the entire humanity.

It is an empirically established fact that there exists a vital link between the environment and the life. History of evolution of life on this planet has taught us that through different ages, according to prevalent environmental conditions, various forms of life appeared and phenomenon of extinction in the adverse environmental conditions, also continued.

Man's activities have now acquired the potential of artificially or unnaturally destroying the creation of nature. For every such unwarranted and irrational activity, interfering with the destiny of creation of nature, humanity will have to pay heavy costs.

In India consciousness towards environmental protection is of recent origin. Legislative measures to protect environment were taken only in this decade by enacting the water Prevention and Control of Pollution Act 1974 and the Air Prevention and Control of Pollution Act, 1981.

Until recently, it seems, we were agreeing with the decision taken by a United States Court in the year 1905 that aesthetic considerations were a matter of luxury and indulgence rather

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then of necessity and it was the necessity alone which justified exercise of Police Power.¹

Judicial approach in the case of *Ratlam Municipality V. Vardhichand* AIR, 1980 S.C. 1622 has marked a high advancement in the direction of achieving the ideal of social justice, provides shelter to a number of interests of social importance, one such interest that has been upheld is the deep concern of the society in a healthy and clean environment. It was observed that the public nuisance, because of pollutants being discharged by big factories to the detriment of poorer sections, is a challenge to the social justice component of the rule of law. Decision, speaking through justice Krishna Iyer, has invigorated the substantive and procedural statutory provisions of law by requiring them to be interpreted in the light of social justice orientation imparted by our Constitution. Decision further enhances the scope of achieving social justice by making judicial discretion of mandatory import. When a public functionary like a magistrate is satisfied of the existence of public nuisance and he considers that such nuisance should be removed from any public place which may be lawfully used by the public, he shall act. Apart from this, court has also deposed its faith in community orientation of public interest litigation. In this regard we have concurred in more or less the same terms with the supreme court of United States ; which ruled : "Standing is not confined to those who show economic harm, aesthetic and environmental well being like economic well being are important ingredients of the quality of life in our society, and the fact that particular environmental interests are shared by the many, rather than the few, does not make them less deserving for legal protection through the judicial process."²

Legal ideals with respect to environmental protection are in the embryonic stage of development. Concepts of social development, control over individual freedom, costs of pollution control, etc. are necessary nutriments for the development of these ideals. Importance of legal ideals lay in that are frequently applied, consciously or otherwise, in the administration of justice. A brief account of the analysis of some of these concepts is given under.

Development Versus Pollution Control

The concepts of development and pollution control are not opposed to each other as they are generally understood.

Just as in the natural phenomenon, there developed from primordial matter a highly complex universal system with innumerable modifications. Similarly social system has developed from primitive to more and more advanced forms, and will continue to be so in the future. Creation is the result of harmony. There must have been a harmony in the natural forces, otherwise universal creation would not have been possible. The way universal intellect has taken care of maintaining harmony and regularity in the universal system, similarly human intellect should do, with the social system, in the course of development.

Environmental pollution control never convey the passive idea of environmental preservation in supersession of social development but what does it convey is environmental protection in consonance with social development.

Contradictions are not inherent in the nature of things they appear when the different parts of a system retract from their natural course of development or where the different forces are allowed to work destructively. Environmental pollution has the potential of paralysing the entire development whereas advancements in the economic, scientific and technical and industrial fields will make the development in pollution control easier.

Prohibitory or regulatory laws dealing with various phenomena having the potential of causing environmental pollution should be in conformity with the positive rules of other social sciences employed for economic, scientific and industrial development of the society.

Enforcement of positive rules of social development is beyond the ambit and scope of States directly, and active involvement is mainly an area of individual activity. State while actively fighting with the evil by strict implementation of prohibitory and regulatory laws should also uphold positive rules of other social sciences.

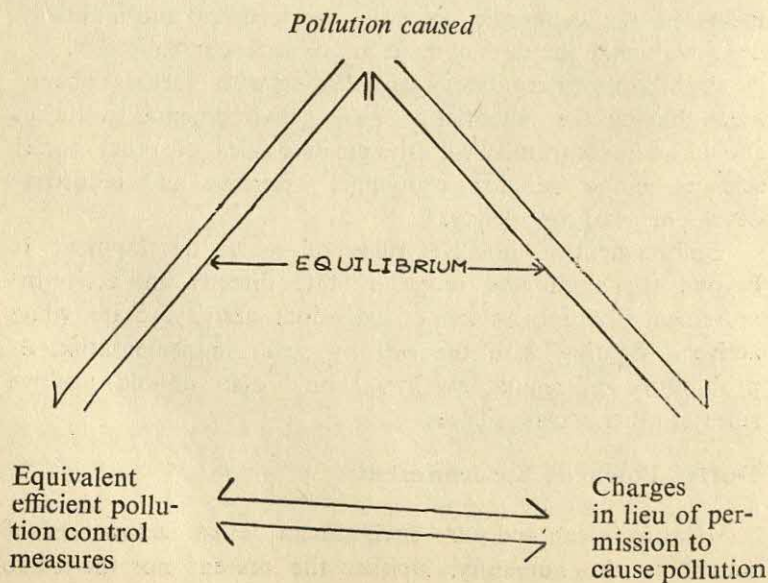
Duties Towards Environment

Healthy, clean and pure environment is an endowment of nature to the humanity. Neither the present nor the future

generations have any right to obliterate its wholesomeness. Every member of the society has an equal natural right to inhabit in a healthy clean environment. Enjoyment in the property of environment is limited in its use so as not to adversely affect either itself or its co-user.

Interaction with the environment in the necessary permissible limits, depending upon the geo-biotic conditions, is inevitable and quite natural in the sense that nature has got, to some extent, the capacity of self restoration. Sphere of such human activity cannot be brought under legal control. Task of scientific and technical experts is to explore the necessary permissible limits of interaction.

So much of interaction with the environment by any person causing pollution can be made permissible that is capable of being mitigated or neutralised by such person or any agency. Here it is worthy to mention that surplus of pollution which has not been mitigated or neutralised, if comes within permissible limits of interaction can also be dispensed with the legal control. According to the scheme mentioned above polluter is a person who fails in not keeping within the permissible limits of interaction, or one who fails in neutralising harmful effects caused as a result of permitted excess of interaction with the



environment under the pretext that such interaction will be counter balanced by adopting equivalent efficient pollution control-measures, or one who does not pay the charges that would be incurred by some agency, in mitigating or neutralising the pollution caused by him, in lieu of permission to cause pollution. The diagram at p. 154 will make the proposition clear.

Need of charging for the pollution caused becomes necessary in view of the fact that obedience with such duties do not merely require abstinence from or compliance with some act which is purely a product of will or desire or intention. Their compliance also requires a high degree of scientific knowledge and technical expertisation. In such cases charges can be levied from the polluters in lieu of the permission to cause pollution. Charges so levied can subsequently be used for pollution Control measures. Geo-Biotic conditions including requirements of the biotic life of particular area should determine what ought to be the quality of receiving media, which in turn should determine the degree of control from the point of view of environmental protection. There exists a direct relationship between the prescribed quality of receiving media and the degree of control that can be exercised in the form of restrictions with respect to discharges and emissions in the environment.

Importance of Judicial Law-making

Existing pollution control laws are subject to two opposing forces provided by two antagonistic groups of environmentalists and the advocates of development, each trying to shift the balance from one end to other over the beam of degree of control of individual freedom.

Importance of law making, particularly in the field of environmental pollution control, is extremely high.

Thesis or the case in favour of pollution control of environmentalist, combined with the antithesis or bias in the favour of development, of any polluter would result in a synthesis, socially acceptable, providing a guideline by which various interests of the society can be set in an equilibrium.

Judicial verdict will bring in to light the shortcomings of our social system and would inspire us to think of the ways of

redeeming them. Relationship of a judge with the society in this sense is that of a doctor and a patient. Duty of legislature would be to procure the required medicine to the society in the form of laws. In this way judicial pronouncements are very likely to become yardsticks of future statutory legislation on the matters relating to environmental protection.

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Environment Management in India : An Overview

B.R. SHARMA*

The Scenario

Generally speaking, environment comprises the overall surroundings of any object. In ecology environment means all factors which affect the survival and reproduction of living organism.¹ When we talk of the pollution of environment, we essentially mean that a source whether natural or man-made is rendered unfit for some beneficial use due to physical, chemical or biological factors. In a country like India where the population explosion is too high, the problem of environmental pollution is further aggravated by both poverty and under-development as well as by the negative effects of the very process of development. In other words, malnutrition, under-nutrition of lack of sanitation, massive industrialization, mechanization, motorization and chemicalization of agriculture have added new dimensions to the problem of environmental pollution *vis-a-vis* its protection and control. Perhaps, the Stockholm Declaration of 1972 to which India was a signatory was the first step towards this end. It was here that all the 113 participating States resolved and affirmed that preservation and improvement of human environment was their bounden duty. This aspect was further emphasised in the *Charter of Economic*

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Rights and Duties of States, 1974.² These two important documents show the deep concern of the international community for taking preventive steps to protect the environment.

It is a matter of great satisfaction that India took note of all these integrated environmental problems and this concern was for the first time articulated in the *Fourth Five-Year Plan*, 1969-1974. The plan drew our attention to the environmental issues in these words : It is an obligation of each generation to maintain the productive capacity of land, water, air and wild life in a manner which leaves its successors some choice in the creation of a healthy environment. . . Planning for harmonious development recognizes this unity of man and nature. Such planning is possible only on the basis of comprehensive appraisal of environmental issues particularly economic and ecological. There are instances in which timely specialized advice on environmental aspects could have helped in project design and in averting subsequent adverse effects on environment, leading to loss of invested resources. It is necessary, therefore, to introduce the environment aspect into our planning and development.”³

The *Sixth Five-Year Plan* (1980-1985) attached great importance to the protection of environment. It has clearly been emphasised that environment should form a crucial guiding dimensions for planning and development. Environment management has to take note of the impact on health and integrity of our natural resources and, soil, water, forests, wild life, etc. Of course, the results of poverty of a large section of our population and the means to fulfil the basic utilities of life like food, shelter, clothing and employment have always to be kept in view. But the environment conservation is, in fact, the very basis of all development.⁴ This concern for environment is clearly visible in our *Seventh Five-Year Plan* which is currently in operation. The establishment of the *Ganga Authority* for cleaning the water of the Ganges and the surrounding slums under the leadership of our young Prime Minister Shri Rajiv Gandhi is a step in the right direction.

The Constitutional Provisions—Creator of Consciousness

The Constitution of India in its Preamble puts social economic and political justice as of foremost value to be secured and protected. This is essential in Desphande's words "a public interest and not a private interest."⁵ The Directive Principles of State Policy in Article 47 clearly underlines the environmental duty of the State to improve public health. Article 48A which was incorporated by the *Constitution* (42nd Amendment) Act, 1976 lays down that "the State shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country." Further, the above Amendment also added Part IVA after Part IV of the Constitution. This part enumerates certain fundamental duties of the citizens of India. Article 51A(g) specifically refers to the fundamental duty regarding environment. The Article says, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures." Looking at the system of distribution of legislative powers, under Article 246, the Parliament of India and the Legislatures of any State have exclusive powers to make laws with respect to any of the matters enumerated in List I and List II in the VII Schedule of the Constitution. In addition to this, they have concurrent powers to make laws on any subject enumerated in List III of the Schedule. Environmental Legislative powers are available in all the three lists mentioned above.⁶ Besides, the Constitution also makes provision for Parliament to make laws in respect of matters assigned to the States or contained in List II.⁷ These provisions of the Constitution are wide enough to empower the State to take all legislative as well as administrative measures which are considered as necessary to protect human environment. The State is empowered not only to frame a policy for the protection of environment but also to take all remedial measures to improve the quality of environment and prevent pollution of environment.

National Environment Policy : An Appraisal

The U.N. Conference on Human Environment held at

Stockholm in 1972 provided impetus for our Union Government to establish a National Committee on Environment Planning and co-ordination in 1972. The Committee has been acting as a high level advisory body to the government and has also done a good amount of work in environmental planning. An appraisal of projects from different areas, survey of wetlands, human settlement planning and the spreading environmental awareness are some of the area which fall within its jurisdiction. The NCEP has set up high level environmental Boards in every State and Union Territory. Later on, as per initiatives of our late Prime Minister Smt. Indira Gandhi, the Congress Government constituted a high powered committee under the chairmanship of Shri N.D. Tiwari⁸ (the then Deputy Chairman of the Planning Commission) in February 1980 to review the existing Lego-administrative framework and recommend some legislative and administrative measures for improving the quality of our environment and ensuring its protection. The Committee in its Report of September, 1980 along with several other recommendations, recommended the creation of a *Department of Environment*.⁹ Accordingly, the Department was setup at Centre in 1980. This department acts as a "Nodal agency for environmental protection and eco-development in the country. It was also to work for carrying out environmental appraisal of development projects. The task of pollution monitoring and regulation, conservation of eco-system as well as marine eco-system has also been entrusted to it.

The DOE functions under the charge of the Prime Minister. The important functions of DOE are, to promote research in environmental problems, policy planning and to maintain liaison with international agencies on environmental issues. The DOE has two bodies to advise and assist it. These are : The NCEP and National Development Board (NDP). Botanical Survey of India,¹⁰ Zoological Survey of India,¹¹ Central Board of Prevention and Control of Water Pollution¹² and National Museum of Natural History work¹³ are the other sub-agencies which assist and strengthen its functional proficiency.

Environmental Protection Law—The Policy Perspective

As we know, environmental law is a newly emerging area of

law. Our laws relating to environmental problems are scattered over different statute books.¹⁴ In recent years our Parliament has enacted the following legislation to save the environment from being polluted.

- (a) The Water (Prevention and Control of Pollution) Act, 1974.
- (b) The Water (Prevention and Control of Pollution) Cess Act, 1977.
- (c) The Air (Prevention and Control of Pollution) Act, 1981.
- (d) The Wildlife (Protection) Act, 1972.
- (e) The Forest (Conservation) Act, 1980 and
- (f) The Environmental (Protection) Act, 1986.

In 1980, the Tiwari Committee, had also noted some of the major shortcomings in our environmental laws and recommended a comprehensive review and reformation of some Central and State laws (such as Insecticides Act, 1968, the Water Act of 1974 and the Indian Forest Act, 1927). The Committee also highlighted the need for enacting legislation for areas of action left uncovered by the present laws (such as those relating to toxic substances). It further suggested the inclusion of 'environmental protection' in the Concurrent List. The Committee, however, regretted that there was no adequate infrastructure for helping the implementing machinery.¹⁵

The basic question which confronts any environmentalist today is : will the enactment of more and more harsher laws solve the problem ? Are our laws effective or conducive in attaining the prescribed goals in the present socio-economic structure of our society ? To what extent these have succeeded in improving the quality of environment *vis-a-vis* its protection. For example, the latest Act of 1986 prescribes five years imprisonment and a fine of Rs. one lakh for the first offence for not carrying out anti-pollution measures by industrial units public or private. Under this law, courts are competent to take cognizance of offences on a complaint made by any person who has given a notice of not less than 60 days for the purpose. Now, if we look at our past experience, we may notice that what is ailing our environmental system is not "a weak or strong

law but the wrong laws based on the nuisance approach," which we inherited from the colonial legacy. In fact, our environmental laws operate on a deterrent theory of criminal justicing system.

For implementing the legal policy under Water Act and Air Act, Pollution Control Boards have been established both at the Union or State level. A close look at the provisions of these laws would show that these Boards mostly consist of inexperienced persons. Often the very undertaking against which the Board has to take action may be represented in the Board. This destroys the impartiality and efficacy of the Board's functioning.¹⁶ The second aspect relates to consent. The Board's consent is pre-requisite for a new or altered outlet or for new discharge of pollutants etc. The Act itself provides that such a consent "shall be deemed to have been unconditionally given on the expiry of a period of four months from the date of making of the application unless the consent is given or refused earlier."¹⁷ This clearly shows that if the consent application is not disposed of within the stipulated period, it shall amount to a grant of implied consent.¹⁸

The third aspect relates to the powers given to the Boards. In the opinion of this author, the powers granted to these Boards are insufficient and are more of an advisory or investigative nature. In other words, the Boards themselves have no powers to take coercive measures against the polluter. Interestingly, the Boards have powers to take action if some effluent is present in a stream or well. But there is no power with them to prevent apprehended pollution. On receiving information about such an apprehended activity, the Boards have to move the court for obtaining an order restraining the person from polluting the matter. This puts these Boards in an unpleasant situation. They can see but they cannot do. Besides, even if the Boards succeed in detecting a violation of the law, the prosecution becomes a futile exercise against industrial giants. Even the prosecutors and the courts may show reluctance in attaching a criminal stigma on such giants who otherwise may be respected citizen.¹⁹

Further, in environmental matter as Dr. Chhatrapati Singh²⁰ says, the laws of evidence do not work in straight forward way as they do not in normal cases of criminal law such as theft,

murder or rape. Thus, the slowness of the litigative process, the faulty legal policies are some of the factors responsible for poor implementation of Legislative measures designed for prevention and control of environmental pollution.

Environmental Impact Assessment—Where do We Fail?

The environment impact assessment procedure is among the tools which in recent years have been employed widely to determine the impact of various activities on the environment with a view to avoid or mitigate such impact. To be able to respond to the challenges which such activities create in the management of the environment, it is becoming increasingly clear that efficient mechanism have to be developed to ensure that any development which is intended is environmentally sound. In the United States, the need for making environmental impact study is recognised. In India, there is no provision in any of our statutes making such study compulsory. Take for instance, the Water Act makes provision for granting or not granting consent to discharge effluents. But Water Board is not legally bound to investigate into this matter or its consequential impact. Though NCEP and DOE do some work in this regard but the basis to prepare or submit their reports is administrative in character and not statutory. Hence, it would be advisable if such an important task is not assigned to an advisory body but be entrusted to an independent agency which should have a complete responsibility of assessing the impact and preparing and monitoring environmental impact—study. No new project should be launched without obtaining a clearance from such an agency. Besides, most of the environmental impacts can be minimised or even completely avoided by adequate and proper pre-planning, through use of techniques like environmental impact analysis for which the interdisciplinary expertise will need to be built up. Environmental considerations, no doubt, form part of our planning for development but they must be supplemented by mechanism to ensure that environmental safeguards proposals are implemented and that there is systematic monitoring to assess their effectiveness.

Public Participation : Access to Information

Members of the public are the most affected victims of pollution. But their participation in the pollution control process is lacking in a developing country like India. In the United States there has been wide public participation in management of the environment. Even the English laws provide for such participation. There are instances where members of the public have brought court actions to challenge the location of industries to abate pollution and more generally, to public institutions to take the environment into account in proposed developmental activities. This also helps in making rational and objective decision making where narrow considerations would otherwise have prevailed. Further to strengthen this process, the people must have a right to receive information or to have information access. Canada has enacted *Access to Information Act* which came into force on July 1, 1983. The basic principle behind the legislation is to make the operations of government as open as possible to the people it serves. A citizen who has not been able to get the needed information, may apply under the above law. The Access Register and Access Request forms are available at public libraries and Government Information offices. The Government has appointed Access Coordinators in each regional office to help those concerned identify the record they wish to see. To make public participation meaningful and purposeful it is utmost desirable that in our country also the public should have a legal right to have access to information in all matters concerning the environment.

Conclusion and Suggestions

A review of the foregoing discussion makes it ample clear that the problem of environmental management is multidimensional. In our Seventh Five-Year Plan the Government has squarely admitted the need for environment management. However, the country suffers from the absence of a sound National Environmental Policy. The Department of Environment is basically an administrative agency having advisory powers. It has no direct legal duty to prosecute the defaulters.

It has also no legal sanction to enforce its policies. Its success or failure is purely dependent on Boards which can prosecute but can't punish the polluters or prevent them from polluting the environment. If the matter is taken to the courts, it takes years together to dispose of a case and the menace remains unchecked.

Hence, the Boards should be given powers to take a direct action against the defaulter. Non-Governmental organisations which are mainly involved in research have no legal duty to press their view points. In this way, their labour and work *vis-a-vis* impact analysis study remains outside the policy-making areas. Hence pollution control agencies should be independent with powers to enforce their decisions. All these bodies like NCEP, DOE and other ones should be manned by experts. Only persons with professional background should be associated with the working of these organizations. Legislative enactments regarding environmental pollution have to be drafted with deep foresight plugging all conceivable loopholes for escaping punishment. Environmental offences should be clearly defined and it should provide for penalties for those who in violation of the laws and regulations on environmental protection shall cause or commit direct or indirect emissions or discharge of any kind into the atmosphere, soil, inland or maritime waters liable to cause serious damage to the health of persons, animal life, forests and natural and cultivated areas. The law should provide for proper environmental impact study which could be better done by giving non-governmental organizations a legal recognition. To make public participation more meaningful, it is essential that members of the public are given a legal right to have access to information to all matters and documents relating to control of pollution.

Thus all efforts should be made towards prevention, reduction and control of pollution. Frequent exchange of views and experiences on implementation measures designed to combat pollution by using present day technology,²¹ should become a regular feature of environment management system. Also reciprocal information on new research findings pertaining to damage could provide a new impetus to curb this menace. Last but not the least, it may be stated once again even at the cost of repetition that a review of the progress made in imple-

menting these measures should become a regular feature of our enforcement machinery.

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2. The charter states in Article 30, "The protection, preservation and the enhancement of the environment for the present and future generation is the responsibility of all States. All States have the responsibility to ensure that the activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. All States should co-operate in evolving international norms and regulations in field of the environment."
3. *Fourth Five-Year Plan (1969-74)*, p. 46 (para II).
4. See, Suresh Jain, ed., *Environmental Laws in India* (1985), p. 592 ; *Sixth Five-Year Plan (1980-85)*, p. 343.
5. *Key Note Address*, given at the National Seminar on "Law Towards Environmental Protection," organised by the Department of Law, Panjab University, Chandigarh in February 1984.
6. In List I (Union list) Entries 52, 53, 54, 55, 57 ; In List II (State list) entries 6, 14, 18, 21, 24, 25 and in List III (Concurrent List) entries 17A, 17B and deal with matters concerning environment, its planning and control.
7. See for example, Articles 252 and 253.
8. Shri N.D. Tiwari is presently holding the portfolio of Foreign Affairs in Rajiv's Government.
9. See Report of the Committee for Recommending Legislative Measures and Administrative Machinery for Ensuring Environmental Protection (The Tiwari Committee Report) (1980).
10. It provides data and information of floral wealth of the country and its conservation.
11. The faunal wealth and its adversity from region to region fall within the scope of this agency. Its principal function is to develop strategies for the protection of endangered species and conservation of fauna in the country.
12. Its jurisdiction is confined to giving advice on matters concerning water pollution and its prevention and control.
13. The Museum serves as a focal point for generating awareness about environmental education to the coming generation.
14. It has been estimated that there are more than 200 Central or State enactments which have a direct or indirect relation with environmental protection. See, Inaugural Address by Shri J.N. Kaushal

- former Minister of Law, at the National Seminar on 'Law Towards Environmental Protection. held at Chandigarh (1984).
15. Tiwari Committee Report, *Supra note* 9, pp, 1924.
 16. In the Boards all nominations are made by the Government. The Act prescribes no qualifications or experience for such nominees. The result is that the persons so nominated have no interest in pollution control activities or policies.
 17. Section 25(7).
 18. This is a point which requires careful consideration because the Board's functioning becomes purposeless.
 19. In Britain the position is just contrary, See *Control of Pollution Act, 1974*, S. 34(2).
 20. Legal Policy for the control of Environmental Pollution, in P. Leelakrishnan, ed., *Law and Environment* (1984), p. 5.
 21. Recently, speaking at a seminar on *Water and Pollution Control* held in New Delhi, Mr. P.C. Tyagi, the Chairman of the Central Pollution Control admitted that India did not have the appropriate technology to meet the effluent standards laid down by the Government to control pollution in industrial Units of highly polluting nature like Cement, refineries, fertilizers, plastics and basic drugs. See, *The Tribune*, Chandigarh, December 7, 1986, at p. 5.

Environmental Guidelines for Afforestation Projects*

YUSUF J. AHMAD**

Introduction

The environmental and socio-economic importance of afforestation projects has grown increasingly in recent years and they are now high of the international agenda for action.

These operational guidelines are designed to enhance awareness of the environmental constraints and benefits associated with afforestation projects. It is hoped that such awareness will promote a more practical approach to solving the specific problems associated with afforestation projects and provide opportunities for anticipatory action to be more fully exploited.

The results of afforestation projects are related to the eco-systems which they replace and the environment generally, in complex and highly interdependent ways. They cannot, therefore, be considered in isolation. It is necessary to take into account from an early or conceptual stage the various impacts that such projects will inevitably have on the ecological balance of a region, the regional climate and the socio-economic well-being of local inhabitants. It is also important to consider how existing environmental conditions will affect the nature and

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scope of the projects undertaken. These interrelationships must be kept centrally in mind during the design and implementation of projects.

Objectives of Afforestation Projects

Afforestation projects are undertaken for a variety of objectives or combination of objectives. When several objectives are pursued simultaneously, the trade-offs between them depend on the type of project, the nature and purpose of the institution which is implementing it, the point of view adopted, and, of course, the broader political, cultural and economic environment within which the project will operate.

The various objectives of afforestation projects can be divided into two overlapping categories : environmental and economic. Of these, some common elements are :

- (a) To restore and protect degraded eco-systems.
- (b) To conserve soil on tropical mountain watersheds.
- (c) To enhance recreational and aesthetic opportunities.
- (d) To restore fertility and productivity to agricultural land and to promote agro-forestry.
- (e) To provide wood for industrial purposes such as the production of gums and resins, oils, paper, textiles, fibres, building materials, etc.
- (f) To provide firewood to urban and rural dwellers.

These different objectives are obviously interlinked. For example, an afforestation project designed to meet the demand for fuelwood will reduce the degradation of natural forests. An afforestation project that emphasizes agro-forestry will support degraded forests by reintroducing a system whereby trees, live-stock and crops can be properly integrated.

Positive Environmental Impacts

Afforestation projects can have important positive effects on the environment.

Effect on Water

As in natural forests, forest plantations can exercise a favourable action on the hydrological balance and the production of water from watersheds. They provide increased opportunities for recharging subsurface flow and ground water :

- (a) Improvement or maintenance of the physical properties of the soil favourable to infiltration, retention capacity and indepth percolation.
- (b) Alimentation of the water table and natural overflow channels by internal drainage of excess water.

Effects on Soil

Forest plantations present important benefits to the soil :

- (a) Reduction of surface flow of water thus reducing sediment movement and delivery.
- (b) Interception and reduction of the kinetic energy of rainfall and obstruction of wind thus reducing erosion.
- (c) Recycling of nutrients and water and the biogeochemical cycling of carbon.

Effects on Climate

The affect of forests on regional and perhaps global climatic and atmospheric phenomena is also significant. The replacement of an eco-system by a forest plantation involves the modification of the plant cover and other physical characteristics : reactivity, absorption of radiation, roughness of the surface, resistance to winds, and therefore, also modifies the fluxes of energy and incident substances. These are internal and external exchanges that influence regional climates. Any modification of the characteristics of the plant cover will generally, therefore, bring about changes in the regional climates. For example, in the case of atmospheric humidity, a dense, humid, evergreen forest plantation that always has reserves of water at its disposal transpires large quantities of water into the atmosphere. Moist forests produce up to half their own rainfall through a rapid

process of transpiration and evaporation. (In contrast, however, even a dense forest formation will, in a sub-humid and semi-arid region, only transpire if leaves are present and if sufficient reserves of water are available in the soil). In addition to overall climatic and atmospheric influences, forests produce important micro-climatic effects.

Negative Environmental Impacts

Afforestation projects can produce potentially negative impacts on the environment.

Genetic Heritage

The biological characteristics of an eco-system can be disturbed or damaged by forest plantations. Plantations can destroy ecological riches and biotypes that were particularly favourable to the development of the fauna and flora species of the eco-system they replaced. They can effectively reduce the richness and variation of the flora and fauna especially if, as is sometimes the case in commercial projects, there is an intervention in well-stocked eco-systems that are not degraded.

Commercial forest plantations can disturb both the micro-climate and the soils of the designated areas. The cyclic return of the critical phase of the harvesting periodically lays bare the soil of the planted areas which can result in erosion and other disturbances. The consequences of this temporary suppression of the forest cover will depend on the period of time that the soil is uncovered, the local conditions, the techniques used for harvesting and the subsequent preparation of the ground for the regeneration of the stands. (In zones where the ground is not too broken and the soil is of a light porous texture, and where the natural regeneration of the coppice is rapid and vigorous, the degradation will be of short duration and without important consequences). The micro-climate, however, will experience an important fluctuation because the various buffer zones provided by plant cover will have been destroyed.

In afforestation projects of exotic species, adverse influences on the original profile of the soil are sometimes evident. These influences include an accentuation of the acidification of the

soil, a deterioration of its structure and a leaching of vital minerals.

Forest plantations in semi-arid to arid zones are often held responsible for consuming large quantities of water to the detriment of other needs considered more important. For example, the supply of water to downstream users and reservoirs is reduced by increased transpiration rates.

Use of Fire

Fires are often used to clear areas, either before tree-planting or mechanical preparation of the land. This practice can have several negative impacts :

- (a) The fires destroy a large quantity of the wood biomass and the litter which has fallen on the soil as well as certain quantities of organic matter accumulated in the upper horizons of the soil. There is, therefore, a reduction in the retention of organic matter in the soil.
- (b) It destroys a portion of the soil fauna on the surface that could otherwise play an important role in the mineralization and decomposition of organic matter.
- (c) It leaves the soil stripped and covered with black ash. This results in a much more intense action of the sun's rays which modifies the micro-climatic conditions on the surface and the biological processes at this level. The consequences are a quite important destruction of the humic clay aggregates and of the soil structure as well as a reduction in water infiltration and the temporary risk of surface flows and erosion.
- (d) It promotes a loss of nutrient elements by internal leaching and by the surface flow of water towards water courses.
- (e) The above impacts can result in a temporary increase in the retention of chemicals in the water ; a modification in the pH ; an increase in the turbidity of the water ; an increase in sedimentary deposits ; and a resulting disturbance of aquatic eco-systems.

Roads, Trails and Firebreaks

The construction of roads and firebreaks through a forest plantation can concentrate and channel the surface flow of water and cause erosion and other damage. This action, although localized, is nevertheless important in transporting sediments toward water courses.

Fertilizers

Massive use of chemical fertilizers involves the risk of interfering with the quality of an eco-system. The most important side effect of their use is the eutrophication of streams, lakes and coastal waters. Eutrophication is a process whereby the nutrients (primarily nitrates and phosphate) in the run-off from fertilized fields promote an excessive growth of algae and other water plants. This results in a deterioration of the quality of water and a threat to aquatic organisms. Fertilizers are, however, less dangerous than herbicides and other pesticides.

Herbicides and Other Pesticides

Chemical products are increasingly being used for controlling adventitious growth and insects in forest plantations. These products are intrinsically very toxic and are dangerous to any eco-system :

- (a) They can accumulate in the soil during relatively long periods of time and pass from there into plants.
- (b) They can be translocated by leaching into subterranean water bodies and contaminate springs.
- (c) They can be transported directly by surface water flows and severely disturb open aquatic eco-systems.

Harvesting and Mechanization

Machines can compact soil unduly and disturb soil horizons. The soil compaction resulting from the passage of heavy machinery reduces the total volume of pores in the soil. This results in poor aeration and causes a considerable reduction in the infiltration and internal percolation of water. The resistance

of soils to compaction depends on their texture, structure and humidity and the amount of weight that has been applied. The damaging effects can be quite considerable, even on humid soils. In addition, machines can damage tree stumps and adversely affect coppice regeneration.

Existing Management Techniques

Biological Diversity

The replacement of a natural eco-system by an artificial mono-specific tree plantation can lead to the disappearance of an important number of plant and animal species. Certain measures can be taken to reduce the magnitude of this loss of genetic heritage :

- (a) Avoid the establishment of excessively large plantations of one species.
- (b) Avoid planting all of the available land.
- (c) Maintain the maximum buffer areas inside the wooded zones so that the natural vegetation is conserved and protected.

Fires

Fires constitute one of the major problems of forest plantations and necessitate important methods of control and protection to avoid degradation and destruction of the afforested areas.

The classic system of firebreaks requires large investments and considerable maintenance without offering a guarantee against wild fires. A simpler and less costly method is the use of premature and controlled burning of the vegetation. Intentional fires, lit under certain specific conditions, limit the intensity and the area of destruction :

- (a) Such fires should be decided on case by case, with special regard given to the fire resistance of the affected species (*i.e.*, trees with thick bark) and should be lit soon after the end of a period of rainfall to allow the

- fire to spread without getting too hot. The tree crowns should be well above the reach of ground fire.
- (b) Specialized techniques exist to determine the parameters which ensure that the fires are lit at a time when maximum protection can be obtained with a minimum of negative impacts.
 - (c) The result of these controlled fires should be a mosaic of scarcely burnt areas.

Roads, Trails and Firebreaks

Roads and paths can concentrate surface water flow and cause erosion. A few simple measure can be taken to minimize the impacts.

- (a) The network of routes, paths and firebreaks that is necessary for the management and development of the planted areas must be well planned and kept to a minimum.
- (b) The routes and paths necessary for site preparation and for planting should be constructed in advance of other work to permit stabilization of the soil and to avoid destruction during the first rains.
- (c) In order to avoid unnecessary road construction, access roads to fire protection systems, such as firebreaks, should be combined with other roads.
- (d) Trails which require the least excavation, digging and filling work should be chosen. These should be constructed according to the latest designs, with special regard to water drainage.

Fertilizers

Although fertilizers are sometimes indispensable in restoring a minimum level of fertility to very degraded or poor terrian (or when commercial forest plantations are harvested in short rotations, thus reducing the level of fixed mineral elements), massive use of fertilizers can interfere with the quality of an eco-system. Certain measures can minimize possible adverse impacts :

- (a) Choosing fertilizers with slow solubility and diffusion to reduce this risks of leaching or superficial transfer.
- (b) Avoiding fertilization during unfavourable climatic periods such as heavy rains. Rains promote surface water flow or leaching to an excessive degree.
- (c) Fractioning of use over limited period.
- (d) Researching/using minimum dosages. The use of correct dosages together with a monitoring of the environmental effects will make curative and anticipatory action easier.
- (e) Experimenting with the biological fixation of nitrogen in the soil. This method utilizes certain forms of bacteria to increase the nitrate content of the soil. It is both less harmful and cheaper than the use of fertilizers.
- (f) Monitoring levels of nitrates and phosphates in the ground water.

Herbicides and Other Pesticides

There is still very little evidence concerning the efficiency of pesticides and the risks associated with their use. It is necessary to pursue in-depth investigations before launching a large scale use of these products. Their utilization requires extreme caution and strict adherence to the recommendations of the producer, as well as specialized and trained personnel responsible for storage, dosage, mixtures and application of the product.

In view of the ecological dangers presented by pesticides it is preferable to :

- (a) Plant tree species which are resistant to potential pests.
- (b) Choose species well adapted to the local eco-system that grow rapidly and vigorously. Many parasites are secondary and only attack species in a poor biological state.
- (c) Mix blocks of different species and of different ages. Each block should be a small individual area.
- (d) Examine methods of biological control and means for propagating natural predators of the pests concerned.
- (e) Use mechanical or manual methods of weeding and

cleaning whenever possible ; these are proportionately less harmful than pesticides.

- (f) Use only pesticides that are biodegradable and can be broken down easily in the environment (organophosphates and carbamates).
- (g) Avoid inappropriate dosages and/or inappropriate techniques of application when resorting to pesticides.
- (h) Minimize the use of pesticides by adopting an integrated approach to pest management : use a combination of biological, technical and chemical means to combat pests.

Harvesting and Mechanization

Avoid disorganized movement of machinery during harvesting : reduce this to a minimum, resorting to winches and cables and careful planning of the operational areas. The superficial layers of the soil should be disturbed as little as possible when harvesting and the slash should not be cleared by fires. The best means of slash disposal is to pulverize the remnants and keep them as a protective mulch until the new shoots appear.

General Considerations

Choice of Tree Species

Local tree species have the indisputable advantage of good adaptation to local conditions. Exotic species often have the advantage of producing wood more rapidly, in larger quantities and of a quality more appropriately suited to specific needs. Exotic species can also, if the case requires, be used only as transitory species destined to create a plantation capable of re-establishing the minimal ecological conditions necessary for the reintroduction of local forest species of greater value. The species one chooses should satisfy the required criteria for their introduction. It is important to define carefully the objectives that one would like to achieve.

Protection Choice

Rapidity of growth and density of foliage are desirable qualities to pursue in difficult situations where it is necessary

to attain full-stocking as quickly as possible and the establishment of a plant cover suitable for ensuring protection of soils. In arid or semi-arid regions, however, there are often not enough water resources to support the fast growing species upon which so many forest plantations are based. Nor should evergreen trees be planted in semi-arid and arid regions, where their continual evapotranspiration provides competition for water resources. Prolific varieties of drought tolerant local trees should be researched and developed.

Silvicultural Techniques

Several techniques can contribute to ensure effective soil protection :

- (a) Conserve all the non-competitive elements of the natural regeneration to ensure an abundant, easily decomposed production of litter.
- (b) Introduce an understorey after a few years.
- (c) Adopt long rotations instead of short rotations. (Each harvesting brings about a baring of the soil, a leaching of nutritive elements and a certain degradation of superficial layers. The worst impacts will result from plantations harvested in short rotations of three-quarters of a year).
- (d) The litter of a mono-specific plantation decomposes less readily than the composite litter of a heterogeneously composed forest. The choice of one adequate species and the introduction of a certain mixture of species in the understorey can solve this problem as can a mixed plantation of at least two species having different rates of development (this will also make the formation less susceptible to pests and disease).
- (e) As regards the temperature of the soil, a well constituted forest plantation provided with herbaceous plant and shrub strata reacts in a very similar way to that of a dense natural forest. The daily thermic range of the superficial layers of uncovered soil is extremely high, whereas the variations under forest cover are much lower.

- (f) Plant tree species that have deep layered crowns. This characteristics permits a plantation structure and architecture that is more complex and results in an internal micro-climate of better quality.
- (g) A dense multi-storeyed evergreen forest offers good resistance to the penetration of external air masses. This transquility of the air is an advantage for the maintenance of a high atmospheric humidity and the retaining of a high level of carbon dioxide. The different strata formed by the crowns of trees and bushes constitute a series of screens in the free atmosphere above the forest and within its interior. The result is a more buffered and stabilized internal micro-climate than in the open.
- (h) The microbial activity, the speed at which litter decomposes, the quality of humus produced and the influence it has on the physical and chemical properties of the superficial layers, depends a lot on the micro-climatic conditions that prevail at ground level. The most favourable conditions are achieved in dense, humid, evergreen formations but these vary in relation to the state of the plant cover and protection that it offers *vis-a-vis* the external climatic factors.
- (i) Plant tree species that are able to regenerate by coppice shoots. This guarantees continuity of reforestation and the rapid restoration of plant cover after harvesting.

Silvopastoral management

Silvopastoral activities do not present appreciable dangers to forest plantations. Controlled grazing allows seedlings to receive more of the soil moisture that would otherwise have been used by grasses. A few measures, however, must be kept in mind :

- (a) Allow only a short duration of pasture to avoid excessive use and destruction of vegetation.
- (b) Organize grazing within specified boundaries with successive rotations.

- (c) Close off grazing areas during rainy periods (especially areas with heavy soils) to avoid serious compaction.
- (d) Determine period of fallow necessary between introductions of livestock.

Agro-forestry

Agro-forestry, like silvopastoralism, is an important means of integrating the project into the local socio-economic context. The following needs attention :

- (a) Choice of agricultural crops should favour tree species ; they should not rob the soil of valuable nutrients.
- (b) The tree species should be such that they can withstand competition from agricultural crops.

Conclusions

Afforestation projects are potentially beneficial to the environment but they can present certain dangers. None of these dangers are unavoidable and with proper management most of them can be circumvented.

A plantation is not completed when all the trees are planted. Proper management is a must. Maintenance, application of appropriate silvicultural treatment, good forest management and protection against predators (man, livestock, wild animals, pests) are the essential factors for success.

It is preferable to establish a small area that is well tended than to establish large areas that are carelessly established and poorly maintained.

Forest, Environment and Development

P.K. SEN-SARMA*

Earth is the only planet in the universe known to sustain life through its various life-supporting systems like air, water and food resources. However, in recent years these life-supporting systems are gradually declining through the capricious exploitation of earth's resources by the ever expanding human population in order to meet its growing material needs in the name of modernisation and development. It is also an irony of fate that the poor majority of the world's population is consuming only a fraction of these resources just to keep their body and soul together, while the rich minority of developed countries is over-exploiting these resources in order to maintain their much higher standard of living without regard to the incalculable harm that is being perpetrated to the posterity. Thus, our relationship with biosphere will continue to deteriorate till a new economic order comes into being when the nature's resources will be exploited and utilised in a more rational way to maintain a sustainable development.

Benefits from Forests

Forests provide a rich variety of goods and services, useful to both affluent and poor nations. Direct benefits are timber, sawnwood and panels for construction, walls, doors, shuttering and furniture, pulpwood for pulp, paper cartons and rayon,

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poles, posts, mining timbers and railway track sleeper, fuel-wood, fodder, fruits, gums and resins, medicinal plants, honey, waxes, edible and non-edible oils, etc. Indirect benefits include environmental amelioration, maintaining CO₂ and O₂ balance in the atmospheres, maintenance of watersheds in optimum condition, soil conservation, maintenance of gene pool, and biological diversity, maintenance of soil fertility through autoregeneration, maintenance of waterflow of the river systems, reduction of sedimentation load in the river streams, etc. facilitating surface water transport system by the maintaining the depth of river water, recharging underground water by means of intercepting water bearing clouds, to cause rains and by reducing surface run-off of rain water, reducing silting of reservoirs, thus maintaining hydroelectric facilities and canal irrigation systems, conserving eco-systems in mountains and hills, etc.

Our Forests

The total area under forests in the world was about 7000 million ha in 1900. By 1975, it was reduced to 2890 million ha. By the 2000 A.D., total global area under forests cannot be more than 2370 million ha if the present trend of deforestation is not reversed (Khoshoo, 1986). It is rather ironical that the reduction in forested areas is more pronounced in the tropical belt of the world rather than in the temperate belt. A reduction of 50 per cent is taking place in Asia and the Pacific among the tropical and sub-tropical countries. This is rather ominous keeping in view the explosion of population of humankind and livestock. Coming to India, *ca.* 90 per cent of the land area was under forests around 3000 B.C. (Warner, 1982). It is believed that hordes of migrants that came to India from treeless countries did not understand the environmental values of forests and denudation of forests continued unabated except during the Mauryan rules. Moghul Emperors converted vast areas of forest land into agriculture land and the British continued the process. During the post-independence period, the destruction and reduction of forested and continued for revenue earning, giant hydroelectric projects, road building (especially in mountaneous and hilly regions), conversion to agricultural land owing primarily

to agriculture dependent population pressure, providing raw material to forest based industries, shifting cultivation and hordes of other causes. Currently though the forested area is claimed to be 67.22 million ha (22.1 per cent of the total land mass), National Remote sensing Agency's photoimagery shows that 13.5 per cent of the total land mass is actually under forest cover. The denudation of forest cover in the ecologically sensitive Himalayan region has already begun to exhibit the adverse effect in the form of increasing shortage of water, recurrent landslides, increasing incidence of floods in the plains, high sedimentation load in the flowing water, shortage of fuel and leaf fodder, decreased availability of grazing areas for sheeps, goats, cows and buffaloes belonging to the migratory Gujars. These have compounded the degradation of forest resources and the consequent devastation in addition to over-exploitation of resources by the expanding population of humankind.

Demand and Supply of Forest Resource

The population pressure coupled with the accelerated rate of economic growth has widened the gap of demand and supply of forest resources which seems almost unbridgeable. According to a projection (Khoshoo, 1986), in 2000 A.D. demand for firewood timber, pulpwood will be 2,25,000 Mm³, 45,700 Mm³, and 77.70 Mm³. According to Thapar (1974), the supply position of fuelwood and industrial wood is only 12.5 Mm³ and 13.5 Mm³. These require stepping up the present supply by 64 per cent, 110 per cent and 323 per cent under the current low income growth of the country. In addition, needs of woody material for wooden crates, panel products and other wood-based industries will also be substantial. These cannot be met from the current levels of productivity of our forest stands.

Environmental Deterioration

Maintenance of ecological process is essential for full protection of health and other aspects of human survival and sustainable development. These factors are essential for sustain-

ing the life supporting systems. Several past civilizations have been destroyed on account of destruction of the ecology. Forests play one of the most vital roles in the system. According to Prof. William Mevvel of USA, the rising carbon dioxide level in the global atmosphere will lead to higher thermal level of the earth thus melting ice-caps and glaciers which, in turn, will increase the water level by as such as 9.3 cm and this level is likely to rise further when other peaks begin melting. This is the direct result of the large scale destruction of forest areas of the globe. It is well known that a portion of the solar radiation is reflected back into the space by the earth's atmosphere. The rest reaches surface of the earth, as not much is absorbed by the atmosphere. This heats the earth's surface. This process can only be halted by increasing vegetational cover to which absorbs carbon dioxide and excludes oxygen. Thus, the deforestation has a most deleterious effect on the quality of life. It is believed that the Ozone layer which prevents ultra-violet radiation from passing through the earth's atmosphere is becoming thinner. This will lead to increased ultra-violet radiation permeating through the atmosphere to the earth. Ultra-violet radiation not only causes heating of the earth's surface but also may directly cause physical harm to people in burning of skin and causing of cancer. This will gradually threaten the existence of life all over the globe.

Due to denudation of forested areas the very life supporting systems are in poor shape. The degradation of watershed has already depleted the water flow in rivers, water falls, etc. On account of lack of recharging of underground water due to surface run-off of rain water, the underground water table is progressively receding deeper and deeper. Large areas of the land have become drought prone. Wells and tubewells dry up sooner than expected during summer months. The same is the case of ponds, tanks, etc. Due to overgrazing the cattle population virtually starve.

Overgrazing also leads to desertification. Domesticated animals are thus deprived of their natural grazing and forage support. These animals also devour various types of plants, thus compounding the already acute problem. This also accelerates soil erosion. The increasing acreage of wasteland in India can be attributed to deforestation coupled with water-

logging and other adverse factors. A few figures are worthy of quoting. Sediment load in Ganga is 1,455 million metric tons per year as compared to Amazon which passes through several Latin American countries (annual sediment load; 363 million tons). The river having the highest annual sediment load is perhaps yellow river of China (Brown and Wolf 1984). High sediment load in rivers results in silting of river beds. India has also the highest erosion of topsoil (4,700 metric tons from cropland alone). Since the topsoil is *ca.* 20 cm thick, erosion of topsoil results in tillage of unproductive subsoil which adversely affects the soil structure that is so vital for good plant growth. Such deterioration of soil coupled with poor nutrient retention capacity lowers the productivity. With a loss of even 2-5 cm of topsoil, production of wheat and maize is reduced by 6 per cent (Brown and Wolf 1984). However, economics of soil conservation measures is high enough to encourage individuals to adopt the same. Hence, the government machinery has to come to the rescue, no matter whatever be the cost, as vegetation cover can only effectively reduce the soil erosion and sedimentation load of rivers.

The number of domesticated harvivorous animal-heads has increased leaps and bounds without corresponding increase in the productivity of the available grassland and grazing grounds. In 1977, India's cow and buffalo population was 179.4 and 61.7 million respectively. The population of sheep and goat was 41.75 million. The total livestock population is projected to be 473 million in 2000 A.D. *i.e.*, it will be almost double (MOA 1984). The number of grazing animals in forest increased from 35 million in 1956 to 54 million in 1972. A forested areas has a maximum carrying capacity of 1.5 ha/cow/yr which is already exceeded. With such a pressure, it is no wonder that our grassland and grazing ground in the villages which are the Common Property Resource of villagers are already highly degraded. The increase in the livestock population in the forested areas is already having its toll in the form of various types of degradation that have already taken place. The entire problem is further compounded by the sharp decrease in the acreage of permanent pastures from 12.78 million ha in 1973-74 to 12.00 million ha in 1980-81 (MOA 1984). National Commission on Agriculture (1976 Vol. IX) has

estimated that as large an area as 88 per cent forested land is open to grazing, as people being around a forested area has grazing rights and privileges. It may be emphasised that grassland is not a climax vegetation. Though moderate grazing in the forested areas often promotes natural regeneration of several forest species, overgrazing has just the opposite effect.

The effect of destruction of forests on the quality and quantity of water is well known. It is a matter of great regret that there is a lack unified strategies for water conservation and rational water harvesting. Multiplicity of authorities is acting as an impediment to conservation of water and its rational management for the benefit of the population. One of the hazards of ecologically unsound irrigation projects is the water-logging of vast areas of irrigated land due to salinity. The total water-logged areas of the country is *ca.* 60 per cent already. If appropriate corrective steps are not taken, the future is bleak. Most of the country's watersheds is situated in the mountains and hills of the Himalaya, Western Ghats and Eastern Ghats. The depletion of adequate forest cover has already resulted in depletion in the quantity of water in rivers, streams, water falls, etc.

Another aspect of environmental degradation is shifting cultivation which is practised in several parts of the country, particularly by the tribals living in mountainous and hilly regions. In olden days when the population pressure was low, this practice did not cause much harm, as the interval of putting the same land under shifting cultivation was long enough to permit revegetation and soil regeneration.

For this a minimum interval of 10 to 12 years in the tropical rain fall areas and 20 to 30 years in dryer areas is required but currently on account of every increase in human population the period of keeping the land fallow after one cultivation is only 3 to 4 years, and this has greatly hampered the regeneration of soil and vegetation with the resultant erosion of top soil and making the land unproductive for cultivation.

The importance of maintenace of biological diversity which includes both genetic diversity and ecological diversity needs no emphasis. The genetic diversity is the amount of genetic variability among individual single species as also between species.

Ecological diversity involves the number of species in a community of organisms. Maintaining both kinds of diversity is fundamental to the maintenance of ecological systems for human welfare. The importance of biological diversity was realized even by our remote ancestors. The famous Ayurvedic physician Charak was asked by his *Guru* (preceptor) to find out one useless plant from the forest areas. It is said that Charak came empty handed and told his *Guru* that he did not find any plant useless. Conservation of biological diversity is also both a matter of insurance and investment. A large number of species, both animal and plants, are progressively getting extinct due to habitat degradation. According to some estimate, at least 10 per cent of the living organisms is either extinct or threatened or vulnerable and the corresponding evolutionary renewals are not in sight. Dr. Swaminathan has called this as "specide" which is equally a hard crime like "genocide". Many of our useful drugs like antibiotics, quinine, etc. are of plant origin. If these material are lost, much of scientific and industrial innovations will be affected. Further, we are morally obliged to our descendents to conserve which we inherited from our ancestors in order to pass on them unspoilt. It is, difficult to predict what species may become useful in future. Many herbaceous plants yield important products like edible tubers, pharmaceuticals, gums, edible and non-edible oils and other useful material. Recent biotechnological innovations are a pointer to this.

Forest Management Strategies

Forestry sector needs considerable attention from planners, administrators and politicians in view of the vital role the forests play in the environmental amelioration, and thus improved quality of life. There is an imperative need to restore the lost ecological balance in all ecological areas including arid and semi-arid zones. This is essential for conservation of biological diversity, catchments for water conservation, reducing the sediment load of our rivers thus preventing flood. National Forest Policy of 1952 stipulated that at least 33 per cent of the land area should be under forest cover. However, this has been followed more in violation than following it up. The complexity

of the situation has been compounded by usurping *ca* 4.2 million ha of forest land by the agriculture alone. In addition, 30,000 km of road has been constructed in the Himalayan region alone by blasting the rocks. Open cast mining operations for iron ore, mica, manganese, bauxite, limestone, etc. have degraded or denuded at least 6,85,700 ha of forested area. This figure belongs to 1973. It must be several times more in 1986. The open-cast mining operations are ecologically highly damaging, as these cause rapid loss of top soil, pollution of surface water, lowering of underground water table, damage to vegetation by reduced photosynthesis due to dust cover on leaves, production of higher sediment volume, blocking natural drainage, etc.

But what are the strategies that need to be followed if we are to avoid environmental degradation caused by deforestation? Current National Forest Policy envisages three pronged strategies :

- (a) Conservation and Protection Forestry, (b) Production and Exploitative Forestry, (c) Social Forestry including afforestation of wasteland. The primary goals for these strategies are : Long term ecological security through conservation of forests, supply of goods and services to people and industry through production Forestry and Social Forestry.

The major aims of the Conservation Forestry are conservation of existing Forests and restoration of the degraded forests in ecologically sensitive areas. These areas should be located in the water regimes in the Himalayas and the Western and the Eastern Ghats, catchments of watershed areas, reservoirs and streams, National Parks, Sanctuaries, Sacred Groves around places of worship, Preservation of plots and Biosphere Reserves, etc. It should be by and large free from commercial exploitation.

Production forests should primarily be located on flat lands and should be managed intensively for much higher productivity from a limited land area so as to meet the demands of people and the industry. This can be achieved by escalating R & D

inputs for higher productivity which is at present abysmally low ($0.4 \text{ m}^3/\text{ha}/\text{yr}$ (Warner, 1982). According to Bentley (1984), most Indian forested areas when well stocked are capable of producing $2 \text{ m}^3/\text{ha}/\text{yr}$. The current consumption can be met if productivity is raised to $2.5 \text{ m}^3/\text{ha}/\text{yr}$. Productivity potential of several indigenous tree species is $17.0 \text{ m}^3/\text{ha}/\text{yr}$ and some exotics have the potential to produce $50 \text{ m}^3/\text{ha}/\text{yr}$ under the current forestry practice (Seth, 1971, Ghosh and Lohani, 1972). In U.S.A., productivity of loblolly pine was increased 3000 times control of weeds, insect pests and diseases, genetic improvement, appropriate thinning practices, drainage/irrigation and use of fertilizers. Thus, the future picture is not as dismal as it appears, provided the government and private agencies come forward with massive investment in R & D. If one adds the areas now defined as wasteland, village common land and agroforestry, the scenario can change dramatically ushering in "*Forest and Ecology Revolution*." Currently many International funding agencies are also coming forward to finance some of our social forestry programmes, the major aims of which being to provide adequate fuelwood for the kitchen, green fodder to the livestock, edible fruits for improved nutrition, small timber for the constructional need of the villagers, etc. The programme will also generate employment opportunities in villages.

Sustainable Development

It seems fallacious to claim that economic development is not always compatible with environmental conservation, as there is hardly any conflict between the two. This point was realised by late Pandit Jawaharlal Nehru as early as 1957 when he observed that ecological imperatives must be taken into consideration before large river valley projects are taken up. Alas, this sound advice was not followed earlier and is also not being followed today. On account of exponential population growth and diminishing resource base, there is an urgent need to strike a balance between environmental needs and economic development. The recent Environment Protection Act 1986 aims at striking this balance. Therefore, any resource based developmental strategy must ensure sustainability of the resource.

Renewability is implicit in it. Thus, a renewable resource like forests requires to be managed in a manner that could ensure continuation of socio-economic development in the long run. It is obvious that planning for sustainable development has to be multi-disciplinary and trans-sectoral. We have not done so as yet even in case of such vital areas like rational utilization of land and water for agricultural, horticultural forestry and plantation crops. Absence of any plan to evolve integrated land management pattern has resulted in compartmentalisation of action plans to the detriment of the broad socio-economic objectives. These problems, be they environmental, or developmental, are also interwoven with exponential growth of population which urgently needs stabilization. For our livestock and social forestry programmes we can make the best use of the common resources of the villages. Conservation of biological diversity is essentially required as an insurance for the future. In conclusion, it is emphasised that a sound environmental policy is a *sine qua non* for sustainable development and forests can play a very vital role in this.

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Himachal State Forest Policy : Its Socio-Economic and Ecological Thrusts

SHYAMA BHARADWAJ* AND PRADEEP VAID**

Forests and Ecological Balance

Ecology : Ecology is the scientific study of the relationships of living organisms with each other and with their environments.¹ It is the science of biological interaction between individuals, populations and communities. Ecology is also the science of eco-systems—the interrelations of biotic communities with their non-living environments. Ecology is directly concerned with environments. It is a natural tool for us insofar as it can provide insight into natural living systems and how they are affected by various kinds of disturbance.² The term ecology³ is derived from the Greek term Oikos, which means “home”. The addition of logy, or “study”, gives us a terms signifying study of the home or environment. Ecology includes man and all living things, and their interrelations with each other and with the environment. The word “Environment”⁴ is defined as the complex of edaphic, climatic and biotic factors that act upon an organism or a community. A standard dictionary

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describes environment as the aggregate of surrounding things, conditions, or influences. During recent years man has been more concerned about his own survival and that of the earth. Thus, ecology has acquired a new broad term—the *Environmental Science*, which focuses greater attention on man and his environment.

Ecological Systems : Ecological systems are not composed of discrete elements called “structure”, and “change”, although it was convenient to break them down in this way. More realistically, ecological systems are interacting assemblages in which any two elements affected the third. One element cannot be modified without changing the other two. Living systems are in dynamic balance with their environments ; that is, their structural and dynamic patterns are determined by an interaction of environmental forces that constantly change. Consequently, real systems constantly adapt in response to changing conditions. It is not a simple matter to draw the same line between an ecological systems in steady state and one that is ready to collapse because survival depends upon many dynamic alternatives, few of which are evident without study. The principle of ecology that have been developed are most relevant to non-human system because biological limits to behavioural pattern can be shown ; that is, the organism involved are limited in their capacity for social decision making.⁵

Concepts of Forest Ecology : The forest is one of the basic physiognomic life forms by which biotic communities may be classified. Characterized by the predominance of woody vegetation substantially taller than man, forests are widespread on land surface in humid climates outside of the polar regions. The forest may be considered as an assemblage of plants and animal living in a biotic association, or biocoenosis. It is biological community dominated by trees and other woody vegetation.⁶ Ecology is the science of interrelationships of organisms and their complete environment. Forestry ecology, therefore, is concerned with the forest as a biological community, with the interrelationships between the various trees and other organisms constituting the community, and with the interrelationships between these organisms and the physical environment in which they exist.

Sustainable management of sources like forests, requires a

thorough knowledge of the eco-system, in particular the role played by the different elements, the intra-system cycles and the exogenous and endogenous changes in them over a period of time. The eco-system concept provides a theoretical framework for the study and management of natural resources. The chief components of a forest ecosystem are (a) plants, dominated by trees, forming the primary producers (b) fauna forming the consumer element and (c) decomposers consisting of the microflora and microfauna. Tropical Forest management has seldom been guided by principles of forest ecology. Short term economic considerations have led to management decision that completely overlook the complexities of the forest eco-system. This is most often self-perpetuating in that long term ecological research is ignored or discouraged, affecting the data base which leads to the adoption of simplistic alternatives even when they are known to be sub-optimal.⁷

Forests and Environment

The influence of forests on environment may be localized or far reaching. They depend on a number of factors such as situation, climate and type, condition, size and shape of the forest.⁸

(a) *Climate* : The effect of forest on climate is usually localized but it may reach further a field at times. The sun's rays have less effect inside a forest than outside. This effect goes on diminishing as the forest canopy becomes thicker and deeper. Thus the temperature inside a forest in the tropics is cooler by day than outside. This is also because there is relatively little air movement inside a forest. Its temperature is warmer at night than during the day.

(b) *Rainfall* : Much has been proved and disproved about the effects of forests on rainfall. It seems likely that a combination of factors can cause increase rainfall locally. This can happen when winds pass over large stretches of forest, take up moisture and are then forced upward by hill mass. Such orographic rain fall locally.

(c) *Relative Humidity* : In forest environment the relative humidity is higher than in the open conditions. Within tropical rain forests it may not fall below 80 per cent and indeed, for considerable periods it may be not much less than saturation

point. Agricultural crops may benefit from the high relative humidity in a forest environment.

(d) *Wind* : Forest provide protection against the physical violence of winds. They also prevent the blowing away of soil. The protective value of trees against strong and dessicating winds and cold winds in temperate climates, and against the hot rays of the sun, brings forestry into close association with agriculture. The shelter effects of trees against wind may be localized but a series of properly sited shelter-belts, oriented more or less at right angles to the damaging winds, can help to ameliorate agricultural conditions.

(e) *Soil* : Due to a complex process forests build up and maintain a forest soil in perpetuity. The agencies which co-operate in this evolution are the physical penetration of the roots in the soil and sub-soil, the physiological process by which a tree receives its raw foods from soil and atmosphere and circulates them within itself, the return to the soil of many of these with the fall of leaves and fruits, and the decomposition of this organic material by the micro-fauna and microflora to form humus. The decomposing agencies work much faster on litter in the tropics than in temperate climates and so there is less evidence of a humus layer in tropical forest soil but the presence of organic matter is shown by the darker coloration in the surface layers.

Removal of forest cover may have disastrous results to the soil. In the case of lateritic soil it tends to become hard and unfavourable to free growth. If the removal is for a short period there will be a probably lowering of the fertility. With the return of a forest cover which is maintained for a long time the soil has chance to reconstitute itself.

(f) *Erosion* : When soil is bared long enough to sun, wind and rain it is more than likely that erosion will take place. This gradual destruction of the top soil is accelerated in tropical conditions by a hot sun and heavy rainfall. The heat of the sun pulverizes the soil which may be blown away by wind. Any that remains is washed away by the rain because of the likelihood of a great deal of run-off in these conditions and very little seepage. The steeper the slope the quicker is the speed of run-off and loss of soil.

(g) *Drainage* : Drainage prevents absorption of water by

roots of the trees and its ultimate transportation into the atmosphere. When an area of high forest is clear-felled the water table may rise owing to the absence of the pumping action of the trees. But on the re-establishment of the tree the water table subsides

(h) *Catchment Area* : The maintenance of forest on catchment areas regulates the flow of water on a slope that run-off is reduced to the maximum. At the same time this can be a precaution against the silting of reservoirs. But plantations created on level ground may receive rather than give benefit.⁹

Exploitation of Forests : A Brief Historical Reference

There was a time when forests covered a much larger area of the land surface than they do now. Their partial or complete destruction has been brought about by a variety of reasons but in many cases the primary cause has been man's desire to clear an area in order to grow foodstuffs. Cultivation may have taken place for a short period, after which the farm was abandoned and in due course tree growth would be likely to return. On a small scale this shifting cultivation may not have caused any appreciable destruction to the forest. However, certain forest areas became more and more vulnerable to settled or large scale farming and to permanent clearing for habitation. As time went on, the once so-called inexhaustible forests dwindled both in quantity and quality to such an extent that it proved to be inadequate for the nation's needs, both instantaneous and ecological.¹⁰

Strategy for Forestry vis-a-vis Ecological Balance

Considering the continental dimension of problems, it is difficult to prescribe a universal strategy. However, fundamental objectives should be clearly stated and flexibility should be built in to take into account specific regional and local problems. Prescribing the objectives of forestry depends on how one defines development and here value judgement are inescapable. Taking into account the problems generated by past approach, an alternative strategy has to aim at (a) ecological restoration of degraded and denuded areas and (b) redirecting resources-use to ensure the fulfilment of basic needs of the peoples giving almost priority to those of the neediest.¹¹ Reorienting

forestry to achieve the above objectives are briefly discussed below :

1. Land Use Policy

A forest policy, however well-conceived, could face serious problems at the implementation stage it is not likely with the policies in sector like agriculture, industry and energy. This has been one of the major drawbacks of the 1952 National Forest Policy. Most of the land-use conflicts can be attributed to the divergent objectives pursued by different sectors. To overcome this a comprehensive land-use policy has to be formulated stipulating the basic principles guiding the allocation of land for different purposes. Land-use should be strictly guided by a capability classification so that deterioration from misuse is prevented.¹²

A sound forest policy forms a component of the land-use policy and broadly indicates the priorities in the sector. Since forest have multiple uses, some of which are partially incompatible, guidelines for tradeoffs have to be prescribed. When uses are totally incompatible, zoning can be restored to. Unless the primary function of an area is clearly prescribed, the possibility of diverting it for less important uses is quite high. A functional zoning which will help to meet the broad objectives of forest resource management is indicated below.¹³

(a) *Protection Zone* : Most of such regions which are susceptible to severe erosion can be included in this zone. The primary objectives of management is to ensure ecological stability through watershed protection, conservation of genetic diversity and protection of wildlife and wilderness values. Low-intensity recreation often affects on the primary function of the area.

(b) *Production Zone* : This zone consists of all areas which are intensively managed for wood production particularly to meet the industrial and urban demands. Extensive wastelands available in the country have to be included in this zone and taken up in a phased programme.

(c) *Village Zone* : A village zone is identified and managed with the social objective of meeting basic needs, particularly timber, fuelwood, fodder and green manure. A major part of

the raw material requirements of small scale industries are also to be met from this zone.

2. *Institutional Framework*

Failure in implementing a policy mostly arises from institutional constraints. The emphasis, has to be to create appropriate institutions which enable beneficiaries to have a decisive say in forest managements. Benefits from the protection zone largely accrue to society as a whole, and hence protecting the area has to be under public sector control. This role can be fulfilled effectively by the forest department. Since the objective of management of production zone is to achieve industrial wood supply, industries could also be directly involved in raising and managing plantations. One approach would be lease out a sufficient extent of land to industries so that production of wood is integrated. This is not only likely to reduce the burden on the government, but also help in more efficient utilisation of land than today.¹⁴

3. *Legal Safeguards*

Policy legislation and creation of appropriate institutions are in themselves inadequate to ensure that resources are managed scientifically. A comprehensive legislation form the cutting edge of public policy. The existing Forest Act formulated in 1927 has very limited objectives of keeping away people from forests. Although the National Commission on Agriculture emphasised the need for a development-oriented legislation, the outcome, namely the 1980 Forest Bill, has only made the punitive provisions of the Forest Act more draconian. There are two approaches to provide legal safeguards for ensuring the implementation of a forest policy. Forestry legislation can form part of a comprehensive natural resource management Act or alternatively environmental safeguards can be incorporated into Forest Acts and Rules. Some of the essential components of a forest law are given below:¹⁵

- (a) Activities that are permitted/not permitted should be clearly specified for each zone separately. This should be applicable not only to the public but also to the agencies entrusted with the management of forests in

different zones. At present no legal provision exists to curb mismanagement of forests.

- (b) Agencies concerned with the management of forests should prepare a long term management plan and this should contain a detailed statement of the expected environmental impacts.
- (c) A comprehensive legislation should contain provisions that enable an individual or group to see the intervention of the judiciary for acts of omission on the part of those responsible for management.

National Forest Policy : A National Forest Policy is essential to the proper running of the permanent forest estate but it needs legal backing and permanent service staffed by competent officers to implement the provisions of the policy. To be effective a forest policy needs be on a national basis with clear perception of specific reasons for maintaining and improving the forests.

India is facing an acute shortage of forests and the problem is accentuating every year. The forests were the natural habitat of wide variety of flora and fauna. Of the total geographical land 11 crore hectares under forests according to the stipulations of the National Forest Policy (1952). As against this requirements, the area classified under forests was only 7.5 crore hectares accounting for nearly 23 per cent of the total geographical area. The first Indian Forest Act was passed in 1865 calling for detailed surveys and classification of forest is reserved and protected. The forest policy of 1984 laid down the broad principles under which forests of different types were to be administered. The Government of India enunciated a new Forest Policy in 1952 which apart from taking other steps, classified forests on a functional basis. The Government revised the Indian Forest Act of 1865 with the Act of 1972 and appointed the Central Board of Forestry.¹⁶

Indian Forest : A Tarnished Scene

There is probably no other area of India's environment that has been more viciously attacked and destroyed in the last century than the country's forests. According to Official Statistics India lost between the period 1951-1972, 3.4 million

hectares of forest lands to dams, new crop lands, roads and industries, meaning thereby an annual rate of deforestation of about 0.15 million hectares. Though Government Statistics repeatedly point out that approximately 23 per cent of the country's total area, that is, 75 million hectares, is classified as forest lands. But this seems to be a misleading statement. It simply means that this vast area is under the control of forest departments. There, however, is no guarantee that it has tree cover. A report of the National Committee on Environment Planning also clearly states that not more than 12 per cent of the country's total land surface is under adequate tree cover.¹⁷ The following Table 1 indicates the extent of the forest lost for various logical or illogical reasons during the period 1952-1972.

Table 1 : Forest Area Lost in India During the Period 1952-1972

S. No.	Purpose	Area (in thousand hectares)
1.	River Valley Projects	401
2.	Agricultural Purpose	2,433
3.	Roads and Communications	55
4.	Establishment of Industries	125
5.	Miscellaneous	388
<i>Total Area lost</i>		3,402

This represents an average annual loss of 155,000 hectares

Source: *Forest resources of tropical Asia*, FAO, 1981

As it is clear from the above Table the forest area lost during the last two decades for various reasons has been quite significant. Though comprehensive figures for reclaiming the losses or compensating the forest loss by some alternative afforestation or conservation measures are not readily available, but from the all-round apprehensions expressed about fast receding forest cover in the country indicates the failure or absence of reasonable success of such measures. The F.A.O. report as mentioned below supports this contention.

A 1981 F.A.O. report on Forest Resources of Tropic Asia clearly warns that the region is faced with serious decrease in its forest stock. "There is no evidence to predict that the great variety of forest services and functions, such as harbour-

ing of wildlife, stabilisation of soil and of water can be re-established in the foreseeable future," says the report. The consequences of this excessive deforestation are increasing floods, soil erosion, heavy siltation of dams built at an enormous expense and changes in microclimate : in other words, a progressive depletion of the country's ecological balance, driving it incessantly towards bankruptcy.

Forests in Himachal : The Assets and Liability

On the face value Himachal Pradesh seems to be comparatively in a happier position in the context of national averages. The following Table 2 gives an idea of the area under forests in Himachal Pradesh and at the National level. The per cent forest coverage has also been juxtaposed. Similarly for the population figures in Himachal Pradesh and in the country as a whole per capita forest area has also been worked out and compared.

**Table 2 : Comparative Studies of Forest Resources
(Area Thousands Hectares and
Population Thousands No.)**

	Geographical Area	Forest Area	Percentage of forest to geogra- phical Area	Population 1981 census	Per capita forest Area
Himachal Pradesh	5,567	2,114	38.00	4,238	0.50
India	3,28,779	74,723	22.73	6,81,268	0.11

Source: *India's Forest 1980*, issued by Central Forestry Commission, Government of India.

Against the national average of 22.73 per cent of the area under forests in the country Himachal can boast of 38.00 per cent. Similarly against per capita forest area in the National average of 0.11 (thousand hectares), Himachal has better figures of 0.5 (thousand hectares) per person. But a deeper thought makes this position not so comfortable. Himachal Pradesh consists of hilly terrain criss-crossed by big and small

rivers, rivulets, nallas, glaciers and deep gorges. There is apprehension of erosion every time everywhere whenever extremities of weather strikes. The one-third of the State is snow-bound making any vegetation on that area impossible. Being a State saddled with the responsibility of siting a large number of irrigation and hydroelectric dams Himachal needs a bigger forest cover for their conservation. Similarly roads are life line for a hilly area, being the only transport measure possible, which again is a big drain on ecological balance. Thus, the better figures for Himachal are no consolation. These are rather the danger signals to improve the condition and bring the forest ratio to stipulated 50 per cent of total geographical area without any further loss of time.

Forests in Himachal : An Overview

Himachal Pradesh being predominantly a hilly and mountainous State. Out of the total geographical area of 55,673 square kms. Forests occupy about 21,322 sq. kms. *i.e.*, 38.3 per cent. However, only 9,697 sq. kms. of reserved and protected-forests constituting about 17.4 per cent of the total geographical area are commercially viable and scientifically managed. The State took to planned-forestry development in 1951-52 when its Five-Year Plan was launched. The Forest Department of Himachal Pradesh prepared integrated working plans for the scientific management. In 1966 more areas from Punjab were merged in the State at the time of re-organisation of States of Punjab, Haryana and Himachal Pradesh. Consequently the area under forests increased from about 9,000 sq. km. in 1950-51 to about 21,000 sq. km. in 1966-67.¹⁸ New Plantations are being raised in the State right from the First Five-Year Plan *i.e.*, 1950-51 and the extent of area covered during different plan periods are given in the following Table 3.

Role of Forest in Himachal Pradesh

In hilly areas like Himachal Pradesh, forests not only protect erosion, stabilize water regime and ameliorate physical and climate factors of the locality including the environmental balance. The economy of the State and that of the people also

**Table 3 : Forest Plantation in Himachal Pradesh
During the Period 1950-1983**

S. No.	Period	Area Planted (Hectares)
1.	1950-51 to 1955-56	1,196
2.	1956-57 to 1960-61	4,711
3.	1961-62 to 1965-66	40,903
4.	1966-67 to 1968-69	27,321
	1969-70 to 1973-74	73,349
5.	1974-75 to 1978-79	93,388
6.	1979-80	25,108
7.	1980-81	23,405
8.	1981-82	21,746
9.	1982-83	26,798
Total		3,37,925

Source : Development Profile of Himachal Pradesh, Directorate of Economics and Statistics, Shimla.

closely depends upon the forests. The villagers in Himachal Pradesh depend upon forest for their day to day needs, such as cattle grazing, firewood, timber for agricultural implements and construction. The horticulturists depend upon forests for the supply of trees for the manufacture of packing cases. Industrialists also depend upon the raw material for a number of wood-based industries. Local population also derives some income from the collection and sale of medicinal herbs. They also get employment in forests, working on plantations and nurseries during their spare time. Forests are of vital importance to conserve water and soil to reduce the silt load in the dams constructed on various rivers, and to make continuous flow of water possible in order to meet the requirements of electric generation. The nature's wonderful heritage in the form of wildlife depends on conservation of forests.¹⁹ The following Table 4 underlines the extent of forest revenue in the context of the State revenue as a whole.

The total State revenue has scored an increase of roughly 45 per cent during the period 1975-85 from Rs. 2412.67 lakh to Rs. 13,130.56 lakh. But the revenue from forest showed an increase of barely 67 per cent during the corresponding period

Table 4 : Forest Revenue in Himachal Pradesh in the Context of Total State Revenue During The Period 1970-1985

(Rupees in lakhs)

Year	Forest Revenue	Total State Revenue	Percentage of Forest revenue to total State revenue
1970-71	746.80	2,412.67	31
1974-75	916.36	3,437.02	27
1978-79	1,261.11	4,886.56	26
1979-80	1,615.85	5,612.08	29
1980-81	1,671.78	7,539.40	22
1981-82	1,913.55	9,689.80	20
1982-83	2,196.05	11,728.74	19
1983-84	1,927.24	13,638.05	14
1984-85	1,250.00	13,130.56	9.5

Source : *Draft Annual Plan 1986-87*, Govt. of Himachal Pradesh, Shimla.

from Rs. 746.80 lakh to Rs. 1,250.0 lakh. This can be explained with the following observations :

- (a) Whereas agricultural, industrial and other service enterprises made great strides in their growth, development and expansion, forests, remained by and large stagnant.
- (b) There was an almost three-fold increase (300 per cent) in forest revenue in 1982-83 to that of the year 1970-71, but it again slumped during the next two years. This also indicates the efficacy of various conservation measures adopted by the Government in checking the reckless forest exploitation during the earlier years.

If the second proposition is valid, as indicated by rigorous conservancy measures claimed by the Government, the stagnation in forest revenue, on even fall in terms of steady devaluation of Indian currency during the last few years, can be taken as a healthy trend in the context of ecological balance.

Forest Area in Himachal Pradesh

Despite new plantation claimed to have been raised in an area of 121.65 thousands hectares at a cost of Rs. 2,488 lakh from April 1980 to March 1985, there has only been a marginal increase of 13.5 thousands hectares in the forest during this period. The Comptroller and Auditor General in his report pertaining to Himachal Pradesh for the year 1984-85, which has been placed before the Vidhan Sabha, has observed that the area under forest is 1,326 thousands hectares. This shows that only 23.82 per cent of the total geographical area is covered by forests against the target of covering 60 per cent area as per the national forest policy and 50 per cent as per the State forest policy.²⁰

Table 5 shows stagnation, rather fall in the real area under forests in different categories. There is a marginal increase from 742 km. to 910 km. in unclassified forests category, and from 36 km. to 40 km. in the cantonment and municipal forest category during the decade. All the other major categories of forests show marginal decrease. Thus, the stipulations of National and State policies with regard to afforestation do not seem to be working in the desired direction.

State Forest Policy : An Observation

To give proper orientation to the management of forests, increasing the tree growth and forest areas within the ambit of National Forest Policy, a new dynamic State Forest Policy has been framed and approved by the Government during September 1980 on the guidelines laid down by the late Prime Minister of India in her letter of April 1980 addressed to all the Chief Ministers of India. According to Himachal Government, Himachal Pradesh is one of the foremost States in India to adopt such a progressive policy within the framework of National Forest Policy which is the need of the hour in India. Keeping in view the various compulsions of land uses the State policy provides for bringing at least 50 per cent of the geographical area under real wooded forestry by the year 2000 A.D.²¹ The approach envisages harmonisation of socio-economic growth with eco-restoration, eco-preservation and

Table 5 : Area Under Forests by Legal Classification During the Period 1975-1985

Year	(Area in Kilometres)					
	Reserved Forests	Protected forests including strips	Unclassed forests	Private Forest managed under		Others forests areas
				Sec. 38 IFA 1927	Land pre- servation Act & H.P. PVT. Forest Act	
1975-76	1,826	17,620	742	149	492	898
1976-77	1,826	17,704	742	178	488	868
1977-78	1,826	17,702	742	188	485	868
1978-79	1,823	17,631	718	175	465	868
1979-80	1,825	17,128	731	167	435	868
1980-81	1,825	17,128	731	167	413	868
1981-82	1,825	17,129	731	158	395	868
1982-83	1,825	17,172	910	139	372	864
1983-84	1,825	17,175	910	139	374	861
1984-85	1,825	17,196	910	119	374	861
						21,763
						21,842
						21,847
						21,716
						21,190
						21,168
						21,142
						21,322
						21,324
						21,325

Source : *Forest Statistics 1982*, Department of Forest Farming and Environmental Conservation, Government of Himachal Pradesh, Shimla.

eco-development coupled with increasing productivity of forest. There is serious apprehension about the realisation of the above targets. The report of Auditor and Comptroller General, as mentioned elsewhere, and the real position of area under classified forests during the period 1975-85 (Table 5) are the warning signals in that direction.

However, there seems to be a clear realisation of the importance of the forests in the context of their socio-economic and all the more for their ecological significance. This fact is quite evident from the State Forest Policy enunciations. A general awareness and practical steps in the direction of forests and planting new forests is also evident from the data that are available with regard to the investment and physical targets for relevant schemes. A brief assessment of such measures will be useful.

Table 6 : Investment in Forest Under Different Five-Year Plans

(Rs. in Lakhs)

S. No.	Plan Period	Total Investment	Investment on Forest	Percentage of Forest Investment
1.	First Plan 1951-56	527.25	11.60	2.20
2.	Second Plan 1956-61	1,602.60	5.36	0.33
3.	Third Plan 1961-62	3,384.47	40.39	1.19
4.	Three Annual Plans 1966-67 to 1968-69	9,778.18	101.03	2.54
5.	Fourth Plan 1969-74	11,342.97	793.92	6.70
6.	Fifth Plan 1974-78	16,148.48	1,084.51	6.72
7.	Annual Plan 1978-79 and 1979-80	14,755.53	802.00	5.44
8.	Sixth Plan 1980-85	56,000.00	2830.00	5.05
9.	Seventh Plan 1985-90 (P)	1,33,900.00	10445.00	7.80

Source : Government of Himachal Pradesh, *Draft Seventh Plan (1985), and Draft Annual Plan (1985-86)* Planning Deptt., Shimla.

P = Proposed.

Plan Provisions For Forests in Himachal Pradesh

Investment in Five-Year Plans and Annual Plans is one of the important measures to assess the importance given to a particular segment of administration. It can also help in the assessment of the growth and development of a particular department and its activities. Table 6 gives the investment indices for forests during various plans in Himachal Pradesh in the context of the total plan allocations.

Though in terms of figures investment on forests in Himachal Pradesh has registered a phenomenal increase from Rs. 11.60 lakh during the Plan period to the proposed Rs. 10445.00 lakh during the Seventh Plan. But in terms of per cent investment to the total plan outlay it has shown marginal increase only. There was stagnation, and even fall in investment during the first eighteen years of our planning. It is only during the Fourth Plan and thereafter that there has been a marginal increase. This again points to the possible divergence between the professed policy and the real practice of the State administration with regard to the afforestation stipulations.

New Plantation : 1961-84

New Plantation of trees in classified forests in a good measure in assessing the extent and rate of afforestation. The following Table 7 gives an overview of new plantations of various categories and species of trees in Himachal during the period 1961-1984.

The figures with regard to the new plantation of various varieties of trees in Himachal Forests during the period 1961-1984 is reasonably impressive. There is a steady increase in covered area year after year. Coniferous trees, such as Deodar and Chil in higher hills, and Khair and Eucalypts in the lower areas dominate the plantation. Eucalypts plantation seems to have been discontinued after 1982, evidently, a wise policy. But keeping in view the ambitious goal of 50 per cent forest cover in the State forest policy, this modest annual rate may not be much helpful in the realisation of targetted percentage.

An overview of afforestation schemes during the period 1974-1983, computed on the basis of annual budgetary provision

Table 7 : New Plantation in Himachal Forests During the Period 1961-1984*(Area in Hectares)*

S. No.	Name of Species	Area planted from 1961-62 to 1981-82	Plantations raised during		Total Area Man made forest upto 31.3.1984
			1982-83	1983-84	
1.	Deodar	42,950	3,865	2,286	49,101
2.	Kail	5,054	254	394	5,702
3.	Fir/spruce	8,869	280	246	9,395
4.	Chil	1,18,614	8,487	9,896	1,36,997
5.	Other Coniferous	108	—	—	108
6.	Walnut	1,738	83	64	1,885
7.	Willow	1,838	332	286	2,456
8.	Mapple	53	40	—	93
9.	Khair	63,118	6,275	5,632	75,025
10.	Shisham	2,756	197	262	3,215
11.	Bamboo	1,138	55	60	1,253
12.	Mulbery	1,268	4	—	1,272
13.	Poplar	1,399	395	295	2,089
14.	Robina	4,965	765	550	6,280
15.	Leucalna	—	641	—	641
16.	Eucalyptus	17,115	—	—	17,115
17.	Other Broad Leaved species	33,237	5,134	4,699	43,070
Total		3,04,220	26,807	24,672	3,55,697

Source : *Himachal Pradesh Forest Statistics, 1982*, Department of Forest Farming & Environmental Conservation, Himachal Pradesh Shimla.

and the actual area covered gives a brief idea of the importance attached to forest management and afforestation in Himachal Pradesh. The statistics have been generated on the basis of State sector and Centre separately, and cover both the general and tribal segments of the schemes. From forestry ; reafforestation ; plantation of fast-growing species ; plantation of Deodar, fir and spruce ; mixed plantation of wastelands, development of pastures ; generation of Chilgoza pine, and plantation of rural fuel varieties have been separately covered. Table 8.

Table 8 : Important Plantation Schemes (Forestry) Area Afforested with Cost

(Area in hectares & Cost in '000 rupees)

Name of Scheme	Annual outlay and area covered											
	Fifth Five-Year Plan (1974-78)				1978-79				1979-80			
	Area Planted	Cost	Area planted	Cost	Area planted	Cost	Area planted	Cost	Area planted	Cost	Area planted	Cost
1	2	3	4	5	6	7	8	9	10	11	12	13
<i>State Sector</i>												
1. Farm Forestry												
3 D Programme (Tribal)	7,260	8,364	2,272	6,925	1,174	6,471	355	5,706	2,937	4,183	4,896	9,829
	13	221	93	412	160	76	24	1,312	89	1,985	453	3,376
2. Reafforestation of degraded forests	999	965	1,628	1,380	385	1,930	752	1,708	848	2,168	713	2,617

3. Introductory plantation of fast growing species (Tribal)	16,511	19,692	4,096	6,267	3,233	6,378	3,828	6,859	3,513	8,458	3,232	11,307
	28	31	317	1,326	186	804	178	390	176	839	191	917
4. Introductory plantation of Deodar, Fir & Spruce (Tribal)	14,828	18,369	2,388	4,035	2,820	4,882	3,416	6,534	3,599	8,441	3,455	11,237
	310	699	510	1,252	376	1,611	193	220	27	375	158	363
5. Mixed Plantation of waste lands	1,954	4,688	3,856	3,994	1,465	3,872	2,167	4,890	1,900	5,532	1,565	6,564
6. Development of Pasture grazing (Tribal)	—	—	189	103	423	172	625	481	834	1,018	1,102	1,588
	—	—	125	144	207	185	156	127	136	168	35	116
Total State Sector	41,893	53,029	15,514	25,838	10,429	26,381	11,694	28,227	1,4059	33,167	15,800	47,914

(Contd.)

Table 8 (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Central Sector</i>												
1. Re-generation of												
Chilgoza												
Pine	21	210	46	143	40	250	25	250	18	250	13	250
(Tribal)												
2. Rural												
(Fuelwood												
Plantation	—	—	—	—	—	—	242	801	1,549	2,370	2,054	7,243
Total												
Central												
Sector	21	210	46	143	40	250	267	1,051	1,567	2,620	2,067	7,493
Total												
State &												
Central												
Sector	41,914	53,239	15,560	25,918	10,469	26,631	11,961	29,278	15,626	35,787	17,867	55,407

Source : *Himachal Pradesh Forest Statistics 1982*, Department of Forest Farming & Environmental Conservation,
Government of Himachal Pradesh, Shimla,

gives a fairly vivid picture of the schemes and investment on them.

A perusal of figures relating to the budgetary provisions and the area covered for various schemes indicates that in some sectors there has been a somewhat stagnation for the entire period of ten years. Deodar and fir plantation has infact shown a downward trend which is inexplicable. Similarly the tribal sector grazing land development has infact shown a decline in the last year after showing stagnation all through. The case of chilgoza development in central sector also shows declining trend. In the schemes where the trend is on enhanced investment and increased area covered, the growth has not been much encouraging. This points to the possible shortfall in the projected forest coverage of 50 per cent by the turn of the century.

Provisions for Forests in H.P. During Seventh Five-Year Plan

Some of the salient features of the Seventh Five Year Plan with regard to various schemes related to afforestation and forest-based ecological conservation are being given in Table 9. Sectors such as forestry, soil conservation, raising of plantations and such other scheme both in the Central and State sectors are covered. The allocation in terms of funds, and the projected area to be covered under various schemes have been indicated.

A general perusal of the figures shows a definite uptrend in both budgetary allocations and projected area to be covered under various schemes. These figures do not include administrative, personnel and such other routine budgetary provisions for the forest department of the State. Though the actual achievement will only be assessed at the conclusion of the plan, yet the intentions of the administration are quite evident from the statistics atleast. It is quite clear that the government has started showing greater awareness to the need for quick and diversified afforestation and such other conservation scheme in view of the increasing danger of ecological unbalance.

**Table 9 : Highlight of Seventh Five-Year Plan of
the Department of Forest Farming and
Conservation Himachal Pradesh**

S. No.	Name of Schemes	Rs. in lakhs/Area in hectres
1.	Forestry Sector	Rs. 11,684
2.	Soil Conservation Sector	Rs. 12,967
3.	Forestry Sector (Raising on Plantation)	1,90,000 hectares
4.	Soil Conservation Sector (Plantation and number of soil conservation operation)	1,00,000 hectares
5.	National Social Forestry (Umbrella Project)	Rs. 5,547,00
6.	Production on Forestry schemes (Total Production Forestry Schemes)	Rs. 1,288,00
7.	307 soil conservation (Total State Sector)	Rs. 750.00
8.	Soil Conservation Central Sector (Total)	Rs. 12,217.00
9.	313 Forest (Total Production Forestry)	Rs. 57,575
10.	Soil Forestry (Total Social Forestry)	Rs. 1,80,073
11.	State Soil Conservation Sector (Afforestation)	11,000 hectares
12.	Centrally sponsored soil conservation schemes (Total soil conservation)	93,000 hectares

Source : *Himachal Pradesh Forest Statistics, 1982*, Department of Forest Farming and Environmental Conservation, Himachal Pradesh, Shimla.

Forest Policy : Strategy for the Seventh Five-Year Plan

On the basis of the recommendations, a comprehensive State Forest Policy was enhanced in September 1980 which provides for the following policy frame work.²²

- (a) To increase forest cover in Himachal Pradesh to a level of 50 per cent geographical area by 2000 A.D. which

is the maximum achievable limit taking in view the compulsions of land use, and about one third area of the State being above the snowline, unfit for any vegetation growth.

- (b) Adoption of massive social and farm forestry plantations of broad leave species capable of yielding fodder, fuel, fruits and small timber on waste lands ; and construction of field bunds, and other forestry schemes.
- (c) Plantation of fast growing species in appropriate areas for industrial wood.
- (d) Improvement of pastures to increase their yield.
- (e) Intensive road-side and irrigation Kuhl-side plantations.
- (f) Entire Settlement and demonstration of forests to be completed.
- (g) Regulation of private land holders rights in forests.
- (h) Working plans revision and up-to-dating of working plans to be expedited.
- (i) Moratorium on commercial felling to be clamped by reducing felling gradually.
- (j) Works in forests of Himachal Pradesh to be considered of national importance and financed by the Government of India on 100 per cent basis.

Keeping in view the above objectives laid down in State forest policy and in the context of multi-utility functions of forest and strategic location of the State in the catchment of major river valley projects, the main thrust of the Seventh Five Year Plan would be on :

- (a) Production forestry for raising large scale plantations industrial wood and short rotation fast growing tree crops with special emphasis on poplar plantations as substitute for Fir and Spruce wood for packing cases ;
- (b) Social and Farm Forestry Programme with involvement of the people for raising fuel, fodder and small timber species on Government waste lands and undemarcated protected forests ; reafforestation of degraded forests and construction of field bunds ;

- (c) Maintenance of plantations raised during the last three years to be considered as the first change on all plantation schemes, so that assets created are not destroyed ;
- (d) Settlement, demarcation, consolidation and mapping the forest area ;
- (e) Development of forestry as a support to the rural economy and tribal development through cottage, small medium and large industries particularly in such backward area where the forest constitute a major local natural resources ;
- (f) Inventory, planning, resources management and assessment of the forest potentials ;
- (g) Scientific management of forest resources and complete nationalisation of forests working through the H.P. State Forest Corporation.
- (h) Complete integration of soil conservation and watershed management programmes in the forestry development programmes.
- (i) Soil and water conservation programmes to be considered of national importance.²³

Forest Plantation Schemes

In order to achieve some of the objectives as underlined in the forest strategy for Seventh Plan, a reference to some of the important schemes may be in order.

- (a) *Productive Forestry* : It is proposed to raise plantation of fast growing species over an area of 3,169 hectares and the raising of extensive plantation of industrially important timber species in compact block over an area of 3,163 hectares.²⁴
- (b) *Pasture Improvement* : This scheme aims at improving the quality and quantity of fodder by the introduction of better species, both exotic and indigenous and popularising the rotational grazing practices.

(c) Social forestry schemes

- (i) *National Social Forestry (Umbrella) Project* : This World Bank assisted social forestry project with an outlay of

Rs. 57 crore has been launched during the year 1985-86. This is a five-year project coinciding with the Seventh Five-Year Plan. The scheme aims at raising fuel, fodder and small timber species to meet the basic requirements of people. The afforestation will be done both in the private wastelands and in the government degraded forests.

(ii) *Centrally Sponsored Rural Fuelwood Social Forestry Scheme* : This scheme aims at raising of fuelwood plantations on government wastelands, on village common lands and along the roadside etc. on 50:50 sharing basis subject to the maximum of Rs. 1,000/- as central share. This scheme has been taken up in five districts, viz., Kangra, Hamirpur, Mandi, Solan and Shimla. An area of 3,970 hectares will be planted under this scheme.

(iii) *Centrally Sponsored Small and Marginal Farmers Scheme* : This scheme aims at raising plants and distributing the same to small and marginal farmers on 50:50 sharing basis between the Centre and the State. Under this scheme, a target of raising 34.50 lakh plants through small and marginal farmers has been fixed.

(iv) *Regeneration of Chilgoza Pines* : (Centrally sponsored Scheme)—Chilgoza forests which are valued for edible seeds are found in dry zones of Kinnaur district and to a limited extent in Pangi in Chamba district in an area of about 2,060 hectares.²⁵

(d) *Dhauladhar Farm Forestry Projects*

This is a continued project of the Sixth Five-Year Plan being executed in Binwa Catchment of Dhauladhar Range with the collaboration of the Federal Republic of Germany. This is an integrated project of afforestation and wood saving. It is proposed to increase forest area by 10 per cent under this project.

Summing Up

There is no denying the fact that this fact has duly been recognised by the society as well as the administration that the existence of human race depends on the existence of balanced

ecological system. Chipko movement in U.P. Hills, silent valley preservation movement in Kerala or the opposition to the siting of Mathura oil refinery as a danger to Taj are only a few of the examples of such consciousness. Governments and Forest departments all over the country are also showing awareness about the ecological balance, for which forests play the most significant role.

Himachal is slightly happily placed when the figures with regard to the forest area in ratio to the total area of State is compared to the corresponding national figures. Similarly, per capita forest area in Himachal is more than four times that of the National coverage. But Himachal Pradesh has greater constraints to face and greater responsibilities to shoulder. Being hilly and snow-bound State one-third of its area is perennially snow-covered, and thus unsuitable for the growth of any vegetation. Thus, Himachal Pradesh cannot increase its forest area at will. It is prohibitive to reclaim Hill areas. Then the temperate climate of most parts of the State makes quick afforestation difficult. Only some lower valleys are suitable for fastgrowing wide-leaf varieties of trees. But these valleys have tremendous pressure of population, roads and agricultural needs, making it almost impossible to undertake some big-scale afforestation measures.

Higher reaches of the State are criss-crossed with rivers, rivulets, nullahs, streams, ravines and valleys. Soil erosion in such terrain is a big problem. Road-building activity takes its own toll in deforestation, denuding the hills and in landslides and soil erosion. Himachal Pradesh shoulders a very heavy responsibility of maintaining big irrigation and hydroelectric dams, which besides submerging wide areas of lower and fertile valleys, caused deforestation for their construction of linking roads. In this way the slightly better position of Himachal Pradesh in comparison to the national averages is fallacious. A little disturbance of forest cover in Himachal Pradesh creates havoc in Hill areas by way of siltation, land-slides and such other devastations. So it can be underlined that Himachal Pradesh needs a better understanding of the utility of forests with regard to the ecological balance of the State.

The forest policy of the State, the various schemes planned and undertaken, the financial provisions envisaged in various

plans both by the State Government and by the Central Government, the co-operation envisaged of the local populace for various schemes of social forestry, and, ambitious projections for the Seventh Five-Year Plan, and upto the turn of the century all indicate an awareness of the utility of forests not only as a big reservoir of economic resources, but also as the biggest single factor responsible for the maintenance of ecological balance.

There will always be illegal encroachers and poachers on forest resources—both flora and fauna. There will be some inefficient, unimaginative or even corrupt officials and leaders who in connivance with unscrupulous elements will harm the interests of the community for their immediate gains by exploiting forest wealth. But the heartening factor is the repeated assurance one gets at the Government level through their various policy documents, budgetary provisions and formulation of various forests schemes, that Government is aware of its obligations, and is also trying to involve the wider public in this urgent measure of ecological preservation; and thereby self-preservation. There may be errors at planning and execution levels. There may be wrong presumptions and projections. Some of the schemes may prove to be either useless or impracticable. But the more important factor is the realisation of a melody, a sincere effort at diagnosis, and a speedy action-oriented programme to correct it. In all that is available with regard to the Forest Policy, Forest Plans and Projections in Himachal Pradesh, this consciousness and conscious effort is evident. A better eco-system can be expected in the State and its resultant benefits to the State in particular and the nation in general.

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Fragile Ecology of Himalaya

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In Hindu mythology, the Himalaya is the abode of Shiva—the God who symbolizes creation as well as annihilation. The Himalaya has been an eternal source of inspiration to our sages, artists and poets, who have always associated it with Shiva's creativity. They have portrayed it as gigantic as well as a fountain of serenity. Not only this, the Himalaya has been and still is the source and saviour of life in Indian sub-continent. It provides a wealth of natural resources, the most vital being the elixir of life—water. However, during the past few decades and during the last decade in particular, the serenity, to be read as ecological balance, of the Himalaya has been severely disturbed by the shortsighted man. The degradation of Himalaya has reached a stage where if man does not expiate, by trying to restore the ecological balance of Himalaya, for the sins that he has been committing, the Himalaya may start Shiva's 'Tandava' and may even open its 'third eye' to annihilate the human demon. How can we, if at all it is possible, restore the ecological balance and thus appease the Himalaya and save ourselves from its wrath and possible annihilation? Let us ponder over the matter by briefly reviewing the basic physiographic, geologic, seismic and tectonic features of Himalaya and by identifying the causes and possible remedies of degradation of Himalaya.

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Basic Features of the Himalaya

The Himalaya extends from the bend of Indus river in North-West to a similar bend of Brahmaputra in Assam in the East. Its length is about 2,500 Km. While, its width varies between 160-400 Kms. In South, Himalaya is bounded by Indo-Gangetic plains. As we move Northwards, four parallel mountain ranges are encountered. These are—the Siwaliks or Outer Himalaya, the Lesser Himalaya, the Great Himalaya and the Tibetan or Trans-Himalaya. These ranges follow from Kashmir to Assam one persistent NW-SE direction. Territorially Himalaya has been classified into the Punjab or Kashmir Himalaya, the Kumaon-Garhwal Himalaya, the Nepal Himalaya and the Sikkim—Assam Himalaya. The Himalaya has seven of the ten highest peaks of the world, important ones of these being Mt. Everest (8870 m) and Kanchenjunga (8585 m) in Nepal Himalaya, Nanga Parbat (8119 m) in Kashmir Himalaya, Nanda Devi (7822) in Kumaon—Garhwal Himalaya and Namcha Barwa (7761) in Assam Himalaya. Further, the major rivers of Indian sub-continent such as Ganges, Indus, Sutlej, Brahmaputra and Kosi originate in Himalaya. Thus Himalaya is the primary source of water in Indian Sub-continent.

In geological terms Himalaya is the youngest mountain chain in the world. It gained its present form after three orogenic upheavals, the last one occurring about 30 million years ago. The four major subdivisions mentioned earlier are the final result of these three phases of orogeny. These subdivisions are separated by major geologic faults and thrusts. The Siwaliks and the lesser Himalaya are separated by the Main Boundary Fault (MBF), the Lesser Himalaya and the Great Himalaya are separated by the Main Central Thrust (MCT) while the Great Himalaya and the Trans-Himalaya are separated by the Indus Suture Zone (ISZ). Besides these main geologic features these sub-divisions in themselves are savaged with faults, folds, thrusts and other geologic features. This lends a very rugged topography to the Himalaya.

Although the last orogenic upheaval took place about 30 million years ago, the seismologists and structural geologists have established that the Himalaya is still tectonically active

and is constantly rising albeit with a geological pace. Valdiya (1985) has reported that there has been an uplift of Siwaliks to the tune of 30 to 80 m in the MBF region near Nainital in Kumaon and Lansdowne in Garhwal. The major regions of tectonic activity are indeed MBF and MCT.

The Himalayan region has been rocked by moderate (magnitude~6 on Richter scale) to large (magnitude~8 on Richter scale) earthquakes. The most devastating ones being the Assam earthquake of 1897 and the Kangra earthquake of 1905. The seismological studies of Himalaya have revealed that the seismicity pattern of this region follows the trend of major subdivisions. The seismologists have identified many areas of higher seismicity such as Srinagar and Kistiwar in Kashmir, Spiti Valley—Tso Morari in NE Himachal Pradesh, Dharchula—Bajang in Indo-Nepal border Pynthan and Mahabharat in South-Central Nepal, Arun Valley along the Nepal Darjiling border, South Central Bhutan, Kameng in Western Arunachal Pradesh and siang in Eastern Arunachal Pradesh (Valdiya, 1985). The Indo-Nepal border registers maximum number of earthquakes per year. Similarly the areas where micro—seismicity (the occurrence of earthquakes of magnitude less than 3 on Richter scale) in high have been identified (Gaur *et. al.* 1985).

The major Himalayan rivers emerge into the plains through the valleys controlled by transversal faults which are seismically more active than the thrusts. In the gorges of these rivers several major dams are either located or are being constructed or are being planned. One such dam under construction is Tehri Dam in Garhwal Himalaya. This project is a centre of controversy over the wisdom to construct a dam in an area which forms a part of high microseismicity region. Such developmental projects were launched in the past with a total disregard to the ecology of the region. But the present alarming state of fragile Himalayan ecology warrants a thorough review of human activity in Himalayan.

Deteriorating Ecology of Himalaya

The Himalayan ecology is fragile because of high seismicity of the region and the myriad of faults, folds and thrusts in the

region which yield its rugged physiography. Further, the network of numerous rivers, rivulets and springs also contribute significantly to the fragility of the Himalaya ecology. It has been established by the ecologists that deforestation and the unthoughtful human activities of construction, with a total disregard to the ecology, have largely contributed towards destabilization of Himalayan eco-system.

Environmentalists are of the opinion that in order to sustain a stable eco-system in Himalaya, at least 65 per cent of the surface area must be covered with dense forests. In reality, not more than 35 per cent of the surface area in Himalaya is covered with dense forests. Even this figure is on the optimistic side. For most of the States bordering Himalaya the figure is alarmingly low. For example, in Himachal Pradesh it is 16 per cent, in Kumaon Garhwal Himalaya it is 10 per cent, in Jammu and Kashmir it is 7 per cent. This meagre value of area under forest cover is the result of intensive deforestation taking place unabatedly in Himalaya. According to Badhwar (1986) in a period of ten years between 1972 and 1982 the area under forest cover in Himachal Pradesh has reduced from 27 per cent to 16 per cent. In other States around Himalaya the reduction is anywhere between 1 per cent to 5 per cent. Only exception in this regard is Arunachal Pradesh where there was an increase in area under forest cover from 61.5 per cent to 62.5 per cent. Even here as the development of the region is gaining pace the deforestation has started taking place.

Deforestation of the Himalaya has contributed towards the occurrence of events like the July 20, 1970 flood in Alknanda Valley and the August 28, 1978 flood in Bhagirathi Valley which fortunately did not end in the catastrophes that were feared of them. Such events are nature's warnings, connivance of which might lead to utter devastation. The two major impacts of deforestation are:

- (a) Soil erosion and land-slides that in turn lead to silting of rivers, canals and reservoirs of dams, and
- (b) The depletion of water table that results in drying up of springs and eventual desertification of the region.

Soil Erosion

The current average rate of soil erosion in Himalaya is about 1mm per year which is five times faster than the rate that prevailed over past 40 million years. It may be mentioned here that nature, left to itself, takes about 40 years to create the soil cover of 1mm. Deforestation accelerates soil erosion in three ways—firstly in the absence of vegetation which holds the soil *via* the roots, the soil gets loosened, secondly when the rain drops hit the vegetation free soil, it gets further loosened, and thirdly this loose soil gets readily washed by the flowing surface water.

Along with the direct soil erosion, deforestation stimulates the landslide activities prevalent in tectonically weak regions. The landslides, in turn, accelerate the soil erosion. Further, the unthoughtful construction projects with disregard to ecology also contribute to soil erosion.

The eroded soil and the debris material increases the silt load of the rivers. This increase enhances the rate of erosion of river banks and their catchment areas. The sediment transported by the rivers are deposited on fertile lands during floods or get deposited in reservoirs of dams built on the downstream courses. The fast sedimentation in reservoirs reduces the life of the dams thus failing the developmental planning.

Depleted Water-Table

The absence of vegetation does not allow the rain water to seep into the ground. Hence the ground water table gets constantly depleted and the springs are dried up while the surface run off is enormously increased. It is reported that in the Gaula river catchment in Nainital district about 45-46 per cent springs have gone dry or have become seasonal (Valdiya, 1985). Similarly, the studies carried out in an experimental watershed near Chandigarh reveal that the burning of forests increases the peak discharge of runoff by 69 per cent, the felling of trees by 34 per cent and the overgrazing by 32 per cent (Singh, 1981). The occurrence of flash floods is more frequent in deforested areas which deteriorates the quality of soil. These processes

together lead to draughts and in some cases even desertification of the region.

Agencies Responsible for Deterioration of Ecology

The two most important factors that have led to the deterioration of Himalaya ecology are our ever increasing population and the lack of awareness regarding finiteness of Himalayan forests. The increase in population, particularly the rural one, generates more and more demand for fuel wood and pastures for cattle. Further, for development of the region to meet other demands of increasing population, more roads, hydroelectric projects and other structures are constructed. This construction work leads to massive deforestation and its consequences.

The rural population has been meeting their demands of fuel wood and pastures from the adjoining forests with wrongly placed faith in infiniteness of forests. Their attitude has been taking out a finite amount from an infinity will not alter the infinity. Now they are aware that somewhere something is wrong but are unable to pinpoint it. This faith in infinity is prevalent not only amongst villagers but also amongst our city dwellers who visit Himalaya as tourists. They have contributed significantly towards the deterioration of Himalayan ecology by leaving behind their waste and garbage in the forests and by indiscriminately plucking the plants. A glaring example of this is the case of 'Valley of Flowers' where the state of ecology has deteriorated so much that the government authorities are forced to permit only a restricted and controlled flow of tourists to the valley.

Unplanned road construction with a total disregard to ecology has contributed significantly towards the present state of ecology in Himalaya. The construction of 44,000 km. long roads in Himalayan region generated 2,650 million cubic metres of debris. Further, each kilometre of already constructed road produces 550 cubic metres of debris by landslides and rockfalls. Thus every year about 24 million cubic metres of debris slides down killing vegetation and choking the springs (Valdiya, 1985). Similar figures can be worked out for the other development projects.

The legal felling, not to speak of illegal felling, for various

purposes is another major contributor to deforestation. The most glaring example is from Himachal Pradesh where each year trees are felled for generation more than 5 lakh cubic metres of wood to manufacture crates to carry the apple crops of the State. This is constantly depleting the forest covered area in the State. Similar examples can be found in other States.

Remedies for Saving the Ecology

How shall we plan and implement our strategy to reverse the deteriorating trend of Himalayan ecology? The commendable step in this direction was taken by the environmentalist, Sunder Lal Bahuguna, when he launched his 'Chipko Andolan' in Garhwal Himalaya. This movement has been very successful and has generated a great awareness in public and particularly amongst the villagers of the region. However, since the creation of the Department of Environment in Central Government, a concerted and planned strategy can be evolved. The impact of this department is illustrated by the Silent Valley case.

Some of the important steps that we must take are—afforestation hazard zone mapping and abandonment of development projects in hazardous areas, measures for abatement of landslides.

The Central Government has already launched the project of afforestation and of bringing in the wastelands under forest cover. However, no government agency can succeed in such a venture without the active participation of public at large. For this purpose the population of the region must be educated and encouraged to offer their services instinctively. This will be possible once the belief of infiniteness of forests is dislodged and the residents of the region are provided alternative means to meet their fuel and fodder needs.

As already stated earlier, the geologically sensitive areas are extremely unstable and vulnerable to landslides and erosion. The eco-system in such belts is in a very fragile state and even a small disturbance may lead to disastrous events. Though it is a well known fact that the landslides and other related movements cannot be totally prevented but their frequency and severity can certainly be minimized through appropriate engineering and biological measures. In mitigating the environmental

assessment related to such problems, the hazard-zone mapping is essential. The assessment of the magnitude, severity and extent of the hazard and to point out its probable consequences is a basic aspect of the hazard-zone mapping. It is inferred from the studies made in the Himalayan catchments (Joshi, 1986) that the landslide activity and the soil erosion from the catchment is a function of various parameters related to the geology, tectonics of the area, geomorphology of the basins, hydrological conditions and land use of the area.

On the basis of such studies the various regions have been classified as :

- (a) Very unstable high risk zones ;
- (b) moderately unstable medium risk zones, and
- (c) relatively stable low risk zones.

The intensity and severity of the landslides can be minimized by

- (a) afforestation using broad leave plants like poplars, alders, willows, oaks, acacias and certain species of eucalyptus ;
- (b) Plantation of grasses like kikui, shrubs like lantana and the legume like *Pueraria hirsuta* ; and
- (c) abandonment of major construction projects in high risk zones.

In areas where landslides are already prevalent, various engineering remedies adopted to check the further failure are :

- (a) reducing the steepness of the slope,
- (b) construction of masonry retaining walls,
- (c) bolting, anchoring and netting of the affected surfaces.
- (d) grouting of the weak planes, and
- (e) diversion of seepage waters.

The above written lines ring a bell of warning in our ears and asks us to rise up and fight against this looming problem which is all set to devour us. It would be wise to work upon

the remedial measures immediately or face the 'Tandava' of Shiva. It is now left up to us as to which path we choose.

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Environmental Education and Forest Management

S.K. ROUT* AND S.R. GUPTA**

Introduction

Forests form an integral part of land use pattern, and their management is important for delivering benefits to the people. The basic aim of management is to find suitable methods for forest conservation and their sustained production (Puri *et al.*, 1983). For achieving practical aims of forests management, it is essential to bring public awareness about the importance of forests and their conservation. Rational management of forests is possible only through participation of local population in protecting the forests and developing forests resources. This Chapter highlights some important aspects of environmental education *vis-a-vis* the problems of forest management on the basis of observations in outer Siwaliks in North-East Haryana.

Objectives of Environmental Education

The forest resources in Shivaliks have been exploited for a variety of purposes by man. The factors like grazing, agriculture, fire quarrying and human settlements have been significant in

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modifying the forest eco-systems. To reverse the present trend of exploitation of forest resources, there is an urgent need to build a strong public opinion in favour of conservation of forests. In doing so, an education programme must be launched understanding all the factors necessary for successful implementation of forest management plan. In this context, the main objective of environmental education is to acquaint the local people and forestry personnel with practical aspects of forest management and utilization keeping in view the regional problems. With particular reference to North-East Haryana, some important features of forest management are :

(a) *Soil and Water Conservation*

Soil erosion is one of the serious problems in foot-hills of Siwaliks in North-East Haryana. Deforestation and intensive use of land for agriculture are mainly responsible for this problem.

The scientist at the Central Soil and Water Conservation Research and Training Institute, Research Centre, Chandigarh have developed comprehensive and integrated watershed management programme involving both Government agencies and local population (Misra *et al.*, 1980). They have emphasized the need to create an awareness among the rural population about the benefits of Government programme and protection of watershed to maintain soil fertility and checking soil erosion. According to Mittal and Sud (1982), the water resources remain underutilized in foot-hills of Siwaliks and there is lot of scope for water harvesting by constructing small storage tanks in potential areas which may give big boost to farmers for increasing agricultural production.

(b) *Pasture Development*

To control overgrazing in forest areas, the need of local population for grass and fodder must be fulfilled. This can be done through pasture development where grass is planted and fed to the cattle. The farmers should be demonstrated the usefulness of stall feeding and reducing cattle population as suggested by Gupta (1980) while discussing the problem of increas-

ing forest production in submountane regions of western Himalayas.

(c) Afforestation

The participation of local people is essential if afforestation programme is to become successful. There is a need for expanded education and training about various cultural practices used for tree growth. People must appreciate the need for planting trees and can be motivated to grow trees on their private land. Fuelwood plantation with short rotation must be encouraged.

(d) Horticulture and Village Industry

The local population must be involved in as many forms of occupation as possible for earning more money and to avoid damage to forests. Gupta (1984) has discussed about the economic plants for small scale industry and their importance in rural development. The motivating approach is to offer opportunities for earning extra income at minimum cost. Horticulture, bee-keeping, weaving, poultry and rearing of silk worms are other important components of prosperity approach. The education programme includes improved methods of bee-keeping poultry and sericulture by setting up demonstration plots.

(e) Proper Technology for Agriculture

To meet the food requirements of village population, agricultural productivity must increase. In Siwaliks foot-hills, farming community belongs to weaker section. Therefore, the agricultural performance of farmers is poor. The increase in crop production can be effectively brought about if farmers are given information about high yielding varieties, use of new cultural practices and plant protection measures.

(f) Alternative Sources of Energy

The socio-economic development of rural community depends on adequate energy supply. Development of solar energy use and biogas can give some boost to the economy of local population.

Education Strategy

To overcome the problems of forest management, a planned education strategy has to be developed including personal, social and organisational activities. The personal activities are concerned with socio-economic status, economic motivation, risk orientation and attitude towards forests. The social activities are important and can be launched through social participation and extension education. Organisation activities include an awareness about forest policy, training in silviculture and management practices and extension programme for afforestation. Some important aspects of education strategy in promoting forest management and utilization are listed below.

- (a) A guidance programme in the form of public exhibits and public meeting about the benefits of forest conservation improved soil and water management techniques and pasture development.
- (b) Teaching farmers to put more area under horticulture and forestry than under agriculture.
- (c) Educating farmers to introduce improved cultural techniques in agriculture like construction of earthen tanks for water storage, terrace improvement, and crop improvement through improved varieties of seeds, use of fertilizers, etc.
- (d) Extension programme for afforestation. Some village organisation like village women association and other social development agencies can play a significant role in afforestation programme.
- (e) Educating villagers about the benefits of cottage industry for their economic development.
- (f) Distribution of information material about social forestry, modern methods forestry, horticulture and bee-keeping to schools and village organisation.

To sum up, environmental education is essential for the proper management and utilization of forest resources. Broad (1969) suggested environmental education as a tool of conservation of biological resources. For the educational programmes to [be effective and meaningful, suitable information material

must be available keeping in view the social, cultural and economic aspects of local people.

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Deforestation—A Socio-Legal Conspectus

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Forests are the very basis of our survival as they maintain the proper balance of organisms, chemicals in the environment by producing or absorbing them and preventing soil erosion, floods and droughts etc. In olden days we had plenty of forests and vegetation. However, as long as the forest remained relatively undisturbed the forest floor absorbed most of the water received through frequent rainfall and standing water of the sort required for mosquito breeding was comparatively scarce. In order to take advantage of new agricultural crops and techniques, it was necessary to clear parts of the forests and to stay in the vicinity of the growing crops to tend, protect and harvest them. Clearing parts of the forest and breaking the soil created numerous areas where standing water could accumulate. The already present mosquitoes including the parasite bearing anopheles began to appear in large numbers and were more often successful in finding human hosts.¹ In addition to it the rise of city like settlements marks a part of change in the pattern of human use of the earth and the relation of settlement pattern to use, for it signified a transition from a basically passive taking of what was available to an active exploitation of the potential of natural riches.²

Thus we see that the forests have their own history and importance since time immemorial. Mythologists say that devastating current of Ganga was controlled by dense forests

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which saved the land from its erosion. These forests are facing the perpetual depletory effects of development of science and technology and population explosion. Deforestation breaks the delicate environmental balance, which is maintained by nature itself, floods or droughts are the terrible consequences. "If the rainfall in India had been spread over the greater part of the year, instead of being concentrated in four months, it would have made anormous difference to our lives. There would have been no flood and no drought.³ Forests bear the responsibility to balance the eco-system, but 'today, Himalayan forests are fastly dis-appearing and free from Shivas restraint rivers bring devastating floods not only in the mountains but in the plains as well. Every year hundreds are killed and thousands more are rendered homeless. Thousands of tons of irreplaceable fertile topsoil are washed away wastefully, resulting in declining agricultural outputs thereby adding further pressure on natural resources.⁴ It means that deforestation causes environmental imbalance resulting into soil erosion, floods, droughts, pollution and spread of infectious diseases. Erosion a venerable issue in the history of conservation, is still a very significant ecological factor in the world. The reduction of vegetative cover and the alteration or destruction of watersheds are processes which affect the agriculture, economy standard of living and environmental quality of virtually all nations. Whereas there has been improved control of soil erosion from well-managed agricultural lands, there has been increasing erosion from marginal farms, overgrazed land, mountains and newly graded land related to, highway and powerline construction, industrial construction, suburban development and surface mining. The consequences of land clearing and scaring have been especially far reaching; such activity results in more rapid surface water runoff, soil erosion, stream and river siltation, increased vulnerability to flooding and reductions in ground water supply.⁵

Plenty of trees transpire the water collected on the land and remove the conditions suitable for habitation of mosquitoes carrying a number of contiguous diseases. For example, yellow fever is caused by a virus borne in mosquitoes dwelling on tree tops in latin America and Africa. Tree-felling may result in mosquitoes coming to grounds and ultimately to humans causing yellow fever. Similarly, encephalitis is a viral disease

spread by mosquitoes which may increase on deforestation. Keeping in consideration the importance of ecology and environment to the society Forests Act was enacted in 1927 which sought to consolidate the law relating to forests, the transit of forest produce and the duty leviable on timber and other forest produce. The said Act empowers the State Governments to constitute any forest land or waste land as reserved forest and to issue a notification⁶ to that effect. The Act also provides for the creation of village forests.⁷

State Governments are also empowered to notify⁸ certain trees and forests to be protected and penalize for cutting, converting, collecting or removing forest produces without licence being granted by respective State. State Government can by notification regulate or prohibit the breaking up or clearing of land for cultivation, the pasturing of cattle or firing or clearing of the vegetation to protect against storms, winds, rolling stones, floods and avalanches, to preserve soil from erosion, to maintain water supply in springs, rivers and tanks, to protect roads, bridges, railways, lines of communication and to preserve public health etc.⁹ Apart from it States have ample powers to control transit of timber and other forest produces and to impose penalties for commission of wrongs under the said Act. Thus the Act gave wide powers to States to preserve forests. In addition to it Directive Principles of State Policy¹⁰ and Fundamental Duties¹¹ too speak of preservation of wild life but despite law on the subject deforestation has reached on such a stage that it has created havoc and imbalance in the eco-system. Thousands of trees are felled for commercial or non-commercial purposes. According to the 1982 Citizen's Report on State of India's Environment, "there is probably no other area of India's environment that has been more viciously attacked and destroyed than the country's forests." Though the felling of trees is to be regulated or checked by individual States according to their own rules, and States have enough powers to punish the offenders. There is separate and enough empowered setup of forest department to deal with offences committed under the said Act. Licenses for felling of trees are to be granted by States keeping in view the ecology and environment problem of the locality.

After independence, the Government of India, adopted the

National forest policy wherein it reiterated vehemently the grave need of protection of forests and categorised forests of India into four categories, namely, Protection forests, National forests, Village forests and Tree lands.¹² State Governments were left unfettered in forest administration, provided that it was in consonance with the centre's forest policy for preservation and development of the nation's forest resources. Subsequently, the Forest (Conservation) Ordinance was also promulgated in 1980 to make certain reforms over the preceding Act of 1927 which imposes restrictions on the reservation of forests or use of forest land for non-forest purposes, by States. The Act provides—"no State Government or other authority shall make except with the prior approval of the Central Government—directing that: (a) any reserved forests (within the meaning of expression "reserved forests" in any law for the time being in force in that State) or any portion thereof shall cease to be reserved; (b) that any forest land or any portion thereof may be used for any non-forest purposes."¹³ Despite such laws it has been experienced that in number of States (Karnataka, U.P., Bihar and West Bengal) forests are being denuded in indiscriminately. The main reasons of this deforestation appear to be as under:

- (a) Inactiveness on the part of officers under the law who are the custodians and guardians of forests seems to be the main cause. Strong groups or private contractors fell trees either at the connivance of authorities or by gratifying them or by exercise of political pressure. It is true that bureaucrats, officials of forest department, big contractors and industrialists are parties to this collusion devastating the forests. Dual policy of Government is also responsible for deforestation because the lands out of which the tribes and villagers were given firewood at cheap rates are now being given to industrialists to establish industries, in violation of law. Big contractors are given relief and relaxation in tree felling to get timber for furniture manufacturing. Thus the villagers and tribals are divested of their rights. Bihar Government is receiving Rs. 876.65 lakhs as forest revenue for the past years, but there is no increase of

revenue in spite of increase in rate of tree felling. It is due to rampant corruption amongst forest authorities.¹⁴

- (b) Equally important is the need of people, which is helping deforestation. Immense industries, trucks, cars, engines and buses etc. consume a lot of petroleum, coal and electricity etc. and in addition to it lionshare is held by wood as fuel being used in cooking. Despite the massive development of oil and coal resources, non-commercial energy sources like firewood, agricultural wastes and cowdung are crucial for India's energy. In 1975-76, 28 per cent of total energy consumed in India came from 133 million tonnes of firewood. Therefore, the one reason of deforestation is its use as source of energy.
- (c) Deforestation for commercial purposes like manufacture of furniture, body of vehicles, shops or packings of fruits or sports goods etc. Much greater damage, however, has been done in recent years by the commercial approach of forest department which has led to the cutting down of the rich natural forests for planting of teak and eucalyptus and starting of certain forest based industries like plywood and paper in the district alongwith contracting to supply wood at cheap rates to industries located elsewhere like match factories and rayon pulp factory.¹⁵
- (d) Land consolidation imbibed a sense of insecurity in the minds of farmers as to get their existing fields, therefore, they removed their trees in fields.
- (e) Unawareness as to the importance of forests prevailed for quite a long time which kept the people indifferent regarding forests.
- (f) Large scale, urbanization, colonization and industrialization and construction of roads and water canals and drains covered a lot of forests. We have heard of controversy over construction of dam in silent valley of Kerala covering 9000 hectares but decade old project which has consumed some Rs. three crores has been dropped after a prolonged tussle. With the decision not to build a dam in the valley, silent valley and its unique

flora and fauna are safe from human interference. But the questions raised about development *versus* environment continue to be important. Are the consideration of ecology relevant to a developing country? Can we afford to destroy an irreplaceable eco-system which took 50 million years to evolve.¹⁶

Gradually the phenomenon of deforestation has changed the ecological balance and ultimately monsoon also which has brought awareness amongst masses and diverted the attention of government too. "In fact the forests today must be protected, husbanded and greatly enlarged, rather than subjected to an exploitation—dominated policy that has been the over riding consideration of our official forest policies upto now". . . . In practice, however, the major thrust has been towards extraction and economic exploitation. This has been largely due to a disastrously short sighted approach initially thrust upon us by alien rulers understandably concerned more with relatively short term advantages and outlook rather than with what should be preserved to ensure the long term future well being of the country any its people. Irrespective of what may be said to the contrary this approach, unfortunately, continued to dominate our forestry practices, only lip service being paid all the time to conservation."¹⁷ Now the public has started revolting against deforestation and such grass root level movements started from Uttarakhand in U.P., in H.P. and Karnataka most commonly known as Chipko movement, but it is not the complete solution. To repair the devastated forest following suggestions are submitted for consideration :

- (a) Corrupt practices amongst officials of forest department are to be stopped. Karnataka Forest Minister, Mr. Jivajaye visited the chipko movement spots and admitted the mistakes of forest department.
- (b) Exercise of political influence by private contractors must be checked. Politicking in forest department is also one of the reasons of deforestation. Recently. few letters by Chief Minister of M.P. ordering transfer of conservation officer were published in Jan Satta (A Hindi Daily Newspaper). Thus, under apprehension of

political transfers and interferences forest authorities cannot act fairly and impartially.

- (c) The Chief Conservator of Forests puts the blame entirely on the local population for the rapid destruction of the forests and absolves the forest department, plywood factory and the contractors of any responsibility for it.¹⁸ It is true to some extent that local people have caused damage to forests and illegally encroached the forests, therefore, importance of forests and trees must be told to the masses so that they may help in afforestation and school going students must compulsorily plant varieties of trees under social work programme. In a meeting held in August 1983 in New Delhi, the Director from Ministry of Rural Development said, that coordination between the schools and Gram Panchayats could be developed for afforestation. NCERT has introduced a new subject on environment science for classes I to V and tree planting has been including as a part of community work curriculum.
- (d) There must be certain checks on felling of trees even in one's own land or house, which may be with the approval of forest authorities. Forest authorities may not object in those areas where no fear of soil erosion is existing. But they may ignore another side of the coin that is the role of forests in getting rid of environmental pollution.
- (e) Alternatives of excessive commercial use of timber must be discovered. For example, in fruit growing areas, where thousands of trees are cut mercilessly to manufacture packing cases and cartons which can be replaced by some other material made from recycled wastes etc. Similarly in various spheres, wherever timber is being used, it must be minimised by searching the substitutes of wood and reducing thereby the deforestation.
- (f) As the States have their own schemes and regulations for forests conservation depending upon the density of forests and climatic factors, therefore, difference is bound to be there. Somewhere, trees are marked and in dense forests it is not possible. In the latter case State permits tree felling according to area and in previous

one on the basis of numbers marked on trees but even so in cutting a tree immense little offsprings are also destroyed mercilessly and in addition to it numerous trees are cut, without authority, with the connivance of forest guards, who are supposed to safeguard from illegal felling and illegal encroachments. To cope with such kind of illegal felling certain States have adopted the policy of cutting trees by their own labourers under the supervision of forest authorities and then timber is stacked and disposed of by the department. This policy must be universally applied.

There is no doubt in it that development will carry deforestation with it, for construction of dams forests are to be cleared and displaced persons are to be settled but with greatest care so that lest it create many more problems for ourselves of far greater significance and consequences. "Social forestry as a solution to the firewood crisis was proposed with the best of intentions. But its implementation had disastrous results. Attention was first drawn to our fast falling timber reserves in the early 1960s. To fill the gap it was decided that a fast growing species be planted. The tree chosen by forest department was eucalyptus. The reason : it grows very fast and so forest officials could show their achievements in a very short span of time. Such a scheme was initiated in Karnataka recently. The big farmers took it with zeal. Since eucalyptus trees fetch a higher price than crops, the farmers started growing trees on their crop-lands as well. The result was predictable. Since growing trees on agricultural lands is less labour-intensive than growing crops, social forestry has also resulted in unemployment in rural areas. . .the poor villagers continue to be in the same predicament, with firewood resources dwindling everyday.¹⁹ Though there has been variance in opinions regarding plantation of eucalyptus. As a defence mechanism eucalyptus has few equals. A country as tree hungry as ours, cannot afford to bother about the type of tree, any more than a hungry man can about the quality of food he eats.²⁰ But keeping apart all these things social forestry helps at least in bringing environmental balance and creating a healthy eco-system. Thus need of the hour is to create balance between deforestation and develop-

ment. So far as the law is concerned it is already enough provided that it is implemented in the spirit it was enacted. A sense of responsibility of afforestation must be instilled in individuals and especially village Panchayats can play a vital role in this regard. Grass-root movements like CHIPKO ANDOLANS can do a lot in conservation of environment as they recognise that development and environment go concurrently.

Deteriorating ecosystem has drawn attention of the world countries and made them to organize a U.N. Conference on Human Environment in 1972 at Stockholm. In India a Committee headed by N.D. Tiwari was constituted for Ensuring Environmental Protection in 1980. It was on the recommendation of this Committee, that Department of Environment was established, and Forest (Conservation) Act, 1980 (as discussed earlier) was passed. The Committee observed that environmental laws were ineffective and not being implemented.

A recent report has highlighted the criminal rate of deforestation in Madhya Pradesh. According to the report, submitted by Hyderabad based Remote Sensing Agency working under the Department of Space, within a short span of seven years 20,000 square kilometres of dense forests have been denuded in M.P. It says : "...to allow such a high rate of deforestation is to invite ecological disaster on a large scale." Despite enactment of the Forest (Conservation) Act, 1980, State Governments are least bothered about the Compliance of law. Narmada project, Bodghat Hydro-electric project, Bhentasori project in M.P. and Bhagirathi project in U.P. are the examples where State Government are the violaters of law.

The M.P. Government discovered that there are at least 485 irrigation projects in the State, which violate the provisions of Forest (Conservation) Act, 1980, submerging almost 1 lakh hectares of forest.²¹ M.P. Government deforested 75 hectares of dense forests in Bastar for Bodghat project pending environmental clearance from the Central Government in violation of the Forest Act of 1980.²² If the Government is genuinely concerned about human welfare and balance of eco-system, let it immediately stop work at various dam projects and other development schemes as it did in case of silent valley unless they are immensely beneficial to the man.

The environmental laws alone enacted to prevent deforestation and devastation of dense forest are not the safety valves against oppression and destruction of forests. In order to meet the needs of time, society and environmental balance, our judiciary has not lagged behind. To save environmental deterioration, our Supreme Court has issued directions and passed appropriate orders in a number of cases.²³ Hon'ble Court directed for closure of lime-querries in Doon valley which were hazardous for healthy environment.²⁴ The court has issued interim orders to stop construction of Tehri dam on Bhagirathi undertaken by Government of U.P. on a petition filed by some publicmen of Tehri Garhwal and Uttarkashi alleging the U.P. Government decision as arbitrary, unreasonable, unconstitutional and destructive of the lives and property of thousands of the residents of Tehri Garhwal, Rishikesh and other areas downstream.²⁵

Thus numerous government projects have caused a large devastation of greenery and created an environmental hazard. Courts have started to peep into the lives of people and provide them redress accordingly. Atleast a sense of awareness of their rights other than merely of human existence and to litigate for their enforcement has been initiated percolating into the minds of people. Though the judiciary is keeping pace with the scientific developments and appears to be concerned about the environmental equilibrium, but that is not the end of problem. End lies with the people who make or implement laws and make it a success or failure. Environmental laws need true-hearted implementation by concerned agencies and society as a whole.

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Soil Litter Collemboles and the Effect of Abiotic Factors on the Population Density

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Introduction

Collemboles constitute a dominant group of soil-litter fauna. They participate in improving the soil fertility. The present Chapter is concerned with the qualitative and quantitative estimations of these micro-organisms and the effect of atmospheric temperature, soil moisture and quantity of litter, on their density in deciduous tropical forest stand dominated by *Dalbergia sissoo*. The word soil-litter has been used for loose soil and litter on the soil surface.

Material and Methods

Site : The study site is located on the University Campus at Kurukshetra, where the climate is tropically monsoonic with an average annual rainfall of 800 mm. Most of the rain is received during three wet months of rainy season (July-September) which is followed by cool dry period from October to February (winter season) and hot dry period from March to June (summer season).

Vegetation : The site is a tropical deciduous forest stand dominated by *Dalbergia sissoo* Roxb. The tree canopy was

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close with a few small gaps where tree density was less. There was sparse shrubby undergrowth having the dominance of *Adhatoda zeylanica* and *Capparis sepiaria*. Herbaceous stratum was represented by *Blepharis maderaspatensis*, *Cannabis indica*, *Chenopodium murale*, *Dicanthium annulatum* and *Desmostachya bipinnata*. Canopy and herbaceous stratum were dense during rainy season.

The dominant species *Dalbergia sissoo* was characterized by leaf bearing period from March to October. Leaf fall started from October and reached its peak in winter showing its complete deciduous nature.

A total of 79 species of plants was recorded. Of these 16 were present throughout the year. There were 56 species in rainy season, 50 in winter and 20 in summer. Average litter fall was $4598 \text{ kg ha}^{-1} \text{ yr}^{-1}$.

Sampling : The method for estimating the number of individuals of arthropods in a unit area involved first sampling and then extraction. The sampling was done by using a metallic quadrat sampler of $16 \times 16 \text{ cm}$ with open top and bottom. Sampling was conducted fortnightly for a period of two years from August 1981 to August 1983. On each sampling day, five samples were collected from different spots. The distance between the sampling spots varied from 10 to 15 mts. In summer and rainy seasons, the sampling was done between 07 and 08 hrs and in winter between 08 to 09 hrs. At the time of sampling, the sampler was placed quickly on the spot to avoid the escaping of active arthropods. The loose soil and litter was collected in minimum possible time. Collected samples were kept separately in polythene bags and brought to the laboratory for extraction.

Extraction : The contents of each polythene bag were transferred to an enamelled dish to pick up the macro-arthropods. For the extraction of micro-arthropods, five identical funnels (modified after Macfadyen, 1961) of galvanised sheet were used, one for each sample. An electric bulb of 25 watts was a source of heat and light. It was about 20 cm above the wire gauze of 4 meshes per square inch. The sample from which the macro-arthropods had already been separated by handpicking, was transferred to the funnel and kept on the gauze for 48 hrs. As the bulb was put on, the organisms started moving away from

the source of light. They fell into collecting tube (containing 70 per cent alcohol) kept below the lower opening of the funnel. Maximum temperature recorded in the funnel was 40°C. Problem of separating micro-arthropods from small pieces of litter which fell into collecting tube was overcome by adding 10 ml of xylene and saturated solution of $MgSO_4$ in each collecting tube to separate the arthropods from the soil particles and the pieces of litter. They were kept separately in vials containing 70 per cent alcohol. The left-over material was thoroughly searched under a binocular to extract the remaining arthropods.

The soil moisture was determined by drying the soil samples taken from each sampling spots. Loss in weight expressed as per cent of even dried soil was taken as moisture contents of the soil.

Observations

A total of 70395 individuals belonging to 24 orders were collected from the forest stand during the study period in 260 samples. Of the total number of individuals, Collembola made up 71.7 per cent of Arthropoda and 84.6 per cent Insecta. It was recorded in 98.1 per cent samples and represented by 7 species belonging to families (Table 1).

Table 1 : Percent Contribution of Different Species to the family, per cent of Occurrence in Total Samples and Average Density of the Study Period

Taxa	Contribution %	Occurrence %	Average density
Hypogastruridae			
<i>Xenyttia obscura</i>	92.16	94.23	6986.79
Entomobryidae			
<i>Seira</i> sp.	44.23	82.69	149.78
<i>Lepidocyrtus cryptocephalus</i>	28.95	71.15	98.10
<i>Salina indica</i>	26.82	84.62	90.89
Sminthuridae			
<i>S. niger</i>	84.50	50.00	216.19
<i>S. aureus</i>	13.27	30.76	33.95
<i>Sminthurinus</i> sp.	2.23	21.45	5.10

The population density of collemboles ranged from 23.4 to 39531.2 m^{-2} . No individual was recorded on 12 July 1982 when the temperature was as high as 38°C and the soil moisture was least (Table 2).

Table 2 : Temperature, Soil Moisture, Quantity of Litter and Density of Collembles During Aug. 1981 to Aug. 1982

Sampling Date	Temperature °C	Soil moisture %	Litter g. m^{-2}	Density m^{-2}
24.8	32-33 (32.5)	5.23	1711.32	5460.92
7.9	25-28 (26.5)	2.10	1727.73	835.91
21.9	28-33 (30.5)	2.70	1884.76	1015.61
5.10	26-28 (27)	2.01	1980.46	820.31
19.10	23-26 (24.5)	10.37	2402.34	5531.24
2.11	20-22 (21)	3.04	2514.06	843.74
16.11	19-22 (20.5)	11.26	2883.98	12281.24
30.11	18-20 (19)	6.86	2698.43	11718.72
14.12	15-18 (16.5)	7.11	2832.81	20445.29
28.12	15-17 (16)	3.08	2964.45	3140.61
11.1	14-16 (15)	6.29	3001.17	17249.97
25.1	14-16 (15)	11.69	2927.73	9539.02
8.2	15-16 (15.5)	14.62	2759.37	4328.09
22.2	15-17 (16)	8.64	2803.90	10257.78
8.3	17-20 (18.5)	7.29	2700.78	17226.54
22.3	20-22 (21)	12.66	2393.75	9718.72
5.4	23-26 (24.5)	7.57	2089.84	8695.29
19.4	25-28 (26.5)	6.70	2521.09	2726.55
3.5	34-37 (35.5)	0.56	2910.15	289.06
17.5	25-28 (26.5)	9.38	2815.23	39531.23
31.5	32-34 (33)	2.85	2014.06	3695.31
14.6	32-34 (33)	0.20	2055.46	23.43
28.6	30-33 (31.5)	2.38	2130.46	843.74
12.7	35-38 (36.5)	0.15	1845.70	—
26.7	28-31 (29.5)	8.66	1664.48	1976.54
9.8	31-32 (31.5)	10.68	1526.56	4999.98

Seasonwise, the average density in the first year was maximum in summer and minimum in rainy season, whereas in the second year it was highest in the rainy season and lowest in summer. The reported maximum density in summer of first year was due to early rains. Average density of the study period was 7581.43 m^{-2} .

• *Xenyttia obscura* was the most dominant species and made up 92.16 per cent of the total density of Collembola. It occurred in 94.23 samples and was recorded throughout the year. Its density ranged from 31.25 to 36718.75 m^{-2} . Average density during the study period was 6986.79 m^{-2} .

The effect of abiotic factors on the population density has also been observed. The soil moisture played an important role. This is based on the fact that there was increase in population density of collembolus with the increase in soil moisture on consecutive dates when the difference in temperature was not much. Again, the density declined when the temperature was almost same but the moisture content decreased (Tables 2 and 3).

Discussion

Per cent contribution has been described by large number of workers, but number of species and average density of collembolus have been reported by a few. In tropical forests maximum present contribution, number of species and density were 71.7 (present observation), 45 (Majer and Koch, 1982) and 7581.43 m^{-2} (present observation), respectively, whereas in temperates, these values were 82.40 (DuRant and Fox, 1966), 58 (Marshall, 1967) and $78,000 \text{ m}^{-2}$ (Kitazawa, 1967), respectively.

Generally, two well-defined peaks in the population density of collembolus are recorded. But, Nijima (1971) observed three peaks at about four months' interval.

Attempt has been made to relate the fluctuation in the population density of collembolus with the factors viz., atmospheric temperature, soil moisture and litter. The field observations indicate that soil moisture plays a most dominant role in regulating the populating density. This is supported by the observations of other workers also (Davies, 1928; Strebel, 1932;

Table 3 : Data of Temperature, Soil Moisture, Quantity of Litter and Density of Collembolles During Aug. 1982 to Aug. 1983

Sampling Date	Temperature °C	Soil moisture %	Litter g. m ⁻²	Density m ⁻²
24.8	29-32 (30.5)	5.41	1647.65	6906.23
7.9	30-33 (31.5)	29.6	1767.96	4046.86
21.9	26-34 (30)	0.59	1785.15	203.11
5.10	25-30 (27.5)	0.23	2566.40	70.30
19.10	25-29 (27)	0.25	3078.12	93.74
2.11	20-25 (22.5)	4.21	3289.06	5171.87
16.11	21-25 (23)	1.95	3407.42	1695.30
30.11	15-21 (18)	2.27	2472.65	3515.60
14.12	17-21 (19)	0.77	2724.60	164.05
28.12	11-15 (13)	0.59	2743.35	54.68
11.1	11-15 (13)	6.45	3101.56	10828.11
25.1	15-17 (16)	5.51	3172.26	2734.06
8.2	14-17 (15.5)	6.94	3216.40	19765.61
22.2	16-21 (18.5)	7.30	3093.75	20054.66
8.3	19-22 (20.5)	6.21	2825.00	13156.21
22.3	20-23 (19.5)	5.97	2565.23	8171.84
5.4	25-28 (26.5)	0.54	2335.93	804.67
19.4	20-25 (22.5)	8.13	2755.46	11007.79
3.5	35-37 (36)	0.13	2568.75	132.81
17.5	30-34 (32)	3.17	2450.00	3593.73
31.5	35-37 (36)	0.72	2081.25	1392.80
14.6	29-34 (31.5)	6.95	2000.00	15374.99
28.6	30-32 (31)	5.37	1844.92	11992.17
12.7	28-33 (30.5)	7.14	1697.26	16554.68
26.7	26-28 (27)	7.34	1679.68	19367.16
9.8	29-31 (30)	8.12	1502.73	24195.30

Frenzel, 1936; Argell, 1941; Pearse, 1946; Baudissin, 1952; Kuhnel, 1955; Milne, 1962; Mukharji and Singh, 1967; Nijima, 1971; Price, 1973; and Singh, 1975). Plowman (1979) also maintains that moisture content of soil increases the rate of

decomposition of litter which results in the increase in population density.

Though Nassar *et al.* (1967) and Wong *et al.* (1977) stated that high population density was due to higher organic content in litter, but present observation and those of Williams (1941) indicate that quantity of litter has no direct effect on the number of Collembolus.

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Environment Management in India : A Survey

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In a paradoxical way, it seems to me that some of the most conspicuous manifestations of "environmental awareness" pose a subtle threat to the cause of ecology, in that they are so largely emotional and esthetic. As a clean mind requires clean body, similarly a clean environment is essential for a clean society. Cleanliness has, therefore, been given uppermost importance in our heritage and tradition. What is required is to make every citizen conscious of the environmental importance, need and its essential features once again.

There is a growing concern for accelerated changes towards widespread environmental degradation which are threatening the health and very existence of human life and also an alarmed realisation that much more will have to be done to counter these tendencies as human population increases still further. Such a concern for the creation of healthy environmental-social, economic, political or physical—and its management patterns and places of human living has been meritoriously getting reflections in various national and international conferences such as those of Finland (1971), Stockholm (1972) and Vancouvur (1976) convened under the auspices of the United Nations.

The environment of man consists of both natural and man-made substances and conditions in which and by means of

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which human society satisfies its most varied material as well as cultural needs. In the society, man is connected with his environment by constant interaction. The environment affects man both physically and psychically, forming him and determining some of his characteristics, reactions, etc. On the other hand, man constantly affects the material surrounding him, changing them (in ways both good and bad, from his own viewpoints and that of nature), and thus becoming to a great extent, the creature of the living conditions and style of the generations to come.

The basic prerequisite, for translating the healthy living environment for the future, will thus be to outline an ideal model life for human society, a model of its culture, its style of living, its needs, its materials and its production—on the basis of the development for which it will be possible to satisfy future demands etc.

Realising the importance of environmental pollution problems, the United Nations established a Scientific Advisory Committee in 1968 to consider the question of holding a conference on Human Environment—later held in Stockholm in June 1972. While most of the industrialized countries have shown deep interest and urgency for tackling such a problem, many of the developing countries were sceptical about it. Their thinking was based on the plea that the problem was largely being faced by western countries because of the process of industrialization and urbanization and the developing countries have not to feel much about this alarming problem as the pace in these countries have perhaps not reached to such a height so as to cause danger. Perhaps the developing countries thought it as a conspiracy by the industrialized countries to control the process of industrialization, thus decelerating the efforts of developing countries to remove poverty. These sentiments were generally shared by the developing countries present at the 1972 Human Environment Conference at Stockholm.¹ The Indian Prime Minister Late Mrs. Indira Gandhi, while addressing the conference stated : "The environmental problems of developing countries are not the side effects of excessive industrialization but reflect the inadequacy of development. The rich countries may look upon development as the cause of environmental destruction, but to us, it is one of the primary means of improv-

ing the environment for living or providing food, water, sanitation and shelter ; of making the deserts green and the mountains habitable."

Consequently, concern about environment was shown in India. In fact, India was fortunate to turn her attention to protect its environment during an early stage of growth. The industrial revolution of the West was not conscious of its demands on the environment. The peoples of those countries have awoken to a nightmare. In America, the Environmental Protection Agency estimates that air pollution alone causes the American economy 16 billion dollars a year in property and health damage. Some economists worry that environmental protection and cleanup will fuel the economic spectre of inflation, while others predict that after a short term rise in prices, inflation will be reduced due to increased productivity from healthier workers, and goods will last longer in cleaner surroundings. The government seems to have launched a nationwide environmental consciousness campaign with a view to creating awareness regarding environmental protection at all levels. This challenge is manifested in policy pronouncements of the Government of India. As a result of this, India's environmental plight, "Compounded to seemingly unmanageable proportions by poverty, squalor, shows why environmental problems must be treated as an integral part of the development strategy in this case, tackling poverty, unemployment, disease and ignorance simultaneously."² The year 1972 saw a watershed in the history of Environmental Management in India, when the 24th U.N. General Assembly decided to convene a conference on the Human Environment in 1972 and requested a report from each member country on the state of environment.³ India set up a Committee on Human Environment under the Chairmanship of Pitamber Pant, Member of the Planning Commission, to prepare these reports.⁴ These reports indicated the need for establishing greater co-ordination and integration in environmental policies and programmes. So in February 1972, a National Committee on Environmental Planning and Co-ordination (NCEPC) was established in the Department of Science and Technology.⁵ Prior to this environmental concerns such as sewage, disposal, sanitation and public health were dealt with by different ministries of the Government of India

and each pursued these objectives without any proper coordination system established at the federal or the inter-governmental level. But the formation of NCEPC did not contribute much for the attainment of its objective. There are number of causes responsible for it.⁶ One reason was the fact that different departments started viewing this committee as a competitor rather than a planner and coordinator.⁷

Environmental Problems of India

India's environmental problems can be classified into two broad categories : (a) Those arising from conditions of poverty and under-development. (b) Those arising as negative effects of the very process of the development. The first category has to do with the impact on the health and integrity of our natural resources (land, soil, water, forests, wild life, etc.) as a result of poverty and the inadequate availability, for a large section of our population of the means to fulfil basic human needs (Food, fuel, shelter, employment, etc). The second category has to do with unintended side effects of efforts to achieve rapid economic growth and development. In this latter category would fall distortions imposed on national resources from poorly planned development projects and programmes as well as from lack of attention to long term concerns by commercial and vested interests. Thus, it is clear that a concern for environment is essentially a desire to see that national development proceeds along rational sustainable lines. Environmental conservation is, in fact, the very basis of all development.

Measures to Protect Environment

In India the over-riding concern for environment protection has been stressed in the Directive Principles and Fundamental Duties of Citizens in the Constitution of India. The relevant provisions provide : The State shall endeavour to protect and improve the environment and to safeguard the forests and wild-life of the country (Article, 48 A). It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild-life and to have compassion for living creatures (Article 51 A).

The National Committee on Environmental Planning (NCEP) reconstituted in April 1981, has done valuable work in a number of areas related to environmental planning. These include environmental appraisal of development projects, human settlements planning, formulation of environmental guidelines and creating environmental awareness at various levels.

In the recognition of the need for a fresh comprehensive tool at the administrative and legislative aspects of environmental protection, the Government of India constituted a High Power Committee under the Chairmanship of the Deputy Chairman of the Planning Commission, Shri N.D. Tiwari. The Tiwari Committee as the Committee is popularly known, submitted its report to the Prime Minister in September 1980.

Report of Tiwari Committee

The Tiwari Committee had identified the following major areas of environmental concern :

- (a) Environmental pollution
- (b) Mismanagement of land and water resources
- (c) Depletion of natural resources consciously and in ignorance
- (d) Poor condition of human settlements
- (e) Need for environmental awareness and education.

Some of the important legislative measures suggested by the Committee for recommending Legislative Measures and Administrative Machinery for ensuring environmental protection are as follows :

(i) *Biosphere Reserves* : The Government may consider comprehensive legislation to give effect to the objectives to be served by Biosphere Reserves. Such legislation should include provisions for designating areas characterised by considerable genetic diversity in economic plants or are valuable for serving as 'hot spot screening nurseries' for screening material for the detection of genes for resistance to pests as 'Gene Sanctuaries'.

(ii) *Protection of Grazing Lands* : The State will be persuaded to enact suitable legislative support for the protection of grazing lands.

(iii) *Protection of Endangered Species* : Supporting Indian legislation to effectively implement the Convention on International Trade in Endangered of Wild Fauna and Flora (CITER) to which India is a party.

(iv) *Toxic Substances Control Act* : This is required to ensure the protection of the environment from the sale, manufacture, use and disposal of chemicals other than pesticide.

(v) *Scientific Land Use* : The existing regulations relating to the use of fertile soil for brick making, mining, etc., require careful scrutiny. Suitable legislative provisions will have to be made to prevent the growing abuse of land and for enforcing strict reclamation regimes after the soil is removed for brick making.

(vi) *Prevention of Noise Pollution* : Comprehensive legislation is required to cover the outdated bits and pieces of related unimplemented legislation at present on the statute books.

(vii) *Prevention of Denudation of Forests* : Legislative measures should be devised to curb the degradation caused by the greed of commercial interests through severe punishment while appropriate steps should be taken to meet the needs of those below the poverty line for fuel and fodder.

The Administrative Measure Suggested by Tiwari Committee : The Committee expressed the need for creating a Department of Environment at the Centre.

National Environmental Advisory Committee

This Committee constituted in 1983 for highlighting environmental issues and giving advice on remedial action, raising Public discussion on national issues of environmental significance, promoting public commitment and participation in environmental programmes, and providing feed back on people's perception of national environmental priorities and action plants.

Department of Environment, Forests and Wild Life

A new integrated Department called 'Department of Environment, Forests and wildlife' in the Ministry of Environment and Forests came into being in 1985. The allocation of

work to the new Department includes National Land-use and Wasteland Development council; Nation wasteland Development Board; Central Ganga Authority (CGA), set up in February 1985 in the Department of Environment. The CGA functions under the Chairmanship of the Prime Minister. The secretariat assistance to the CGA is rendered by the Ganga Project Directorate of this Department. The CGA oversees the implementation of the Ganga Action Plan.

Action Taken to Preserve/Improve Environment : The steps taken to preserve/improve the environment have been as follows :

(a) *Pollution Control* : The Cental Board for Prevention and control of Water Pollution, which is under the administrative control of the Department of Environment, together with the State Pollution Control Boards, completed a country-wide rapid inventory of pollution from large and medium industries. This was in execution of the 'Control of Pollution at Source' Programme. Minimal National Standards (MINAS) for polluting discharges from specific industries were formulated, and control measures implemented in a progressively stringent manner. About thirty per cent of large and medium industries of the country have installed pollution control equipment. A network of about 120 monitoring stations to check water pollution has been established. Zoning and classification of all the 14 major inter-State rivers have been completed, to provide a basis for water quality management. The river basin-wise inventory for the Yamuna and Ganga has also been completed.

The Air Pollution Control Act became effective from May 1981. Programmes in progress, after the framing and notification of rules under the Act completed, include strengthening of administrative support systems, inventory of area to be declared air pollution control zones. evolution of ambient air quality standards as well as industry-specific emissions standard.

(b) *Land Resource Management* : Notable efforts have been made to plan, organise and provide funds to improve desert environments. To improve ecology as also to meet the requirements of the local cattle and human population, forestry has been taken up relatively, extensively. Rural electrification with a view to assisting the exploitation of ground water has been promoted. Construction of Rajasthan Canal envisages to

Canal envisages to transform barren un-inhabited areas of western Rajasthan into a vast granary. With a view to meeting the basic and economic needs of the community, the programme of social forestry (which *inter alia* includes Farm Forestry, Extension Forestry, Reforestation in degraded forests and Recreation Forestry) to augment to supply of fuelwood fodder and small timber to rural areas was taken up in the Sixth Plan to cover 100 chronically deficit districts

A National Eco-Development Board has been set up to achieve sustainable economic and social development through national utilisation of resources-water, soil, plant and animal life.

Universities in several States and voluntary agencies organised Eco-development Camps. Task Forces to ex-service personnel for eco-development work in Shivaliks (UP), Rajasthan canal, etc. have been raised. Programmes have also been formulated for extension of eco-development work for mined areas reclamation, environmental improvement in metropolitan settlements, hill resorts, pilgrimage centres and the Himalayan foothills, etc.

(c) *Natural Living Resources* : India has initiated the formulation of a National Conservation Strategy. It has also adopted a National Wild Life Action Plan during the year 1983-84. Thirteen sites in different bio-graphical regions have identified for designation as Biosphere Reserves. Work on environmental impact assessment, wildlife conservation and faunal composition of different eco-systems has been taken up. Studies on faunal composition of marine, estuarine fresh water and terrestrial eco-systems have been conducted in some areas. Activities to survey, identify and investigate plant species are under progress. The Botanical Survey of India (BSI) has set up a countrywide network with Regional offices. It has also been involved in assessment of environmental impact of several developmental projects and inventorisation of Plant resources important eco-system such as the Silent Valley, Sutlej Beas Link, Tehri Dam, Lalpur Dam, Idukki Valley, etc.

The Zoological Survey of India has primarily been engaged in the survey of faunal resources and collection of base-line scientific data with regard to their taxonomy, bio-ecology animal behaviour and pollution etc. Special emphasis was

given to the studies on the ecology and population of rare and endangered mammals and birds, studies and faunal composition of marine, estuarine, fresh water and terrestrial eco-systems were conducted.

(d) *Environmental Awareness Programmes* : There have been addressed to specific target groups, such as planners and decision makers, administrators, executives, student, etc. For higher level administrators, senior executives and planners a series of carefully structured workshops were organised at the Administrative Staff College of India, Hyderabad, the Indian Institute Management, Banagalore and the Indian Institute of Public Administration, New Delhi. To generate environmental awareness in the public, nationwide celebrations of World Environment Day and Wildlife week are organised each year. The first National Environmental Congress and first National Conference of Legislators to Environment have also been held.

(e) *Promotion of Environmental Research* : Promotion of reseasch has been one of the major activities aimed at developing information on various aspects of environment management and for building up of scientific manpower to deal with the environmental problems.

(f) *Environmental Impact Assessment and Monitoring* : Environmental appraisal is an important responsibility assigned to the Department of Environment. This involves evaluation of environment implications and incorporation of necessary safeguards for such activities having a bearing on environment quality. The project authorities are required to incorporate a chapter on environmental aspects in their feasibility reports.

(g) *Centres of Excellence* : Strengthening active research/training groups in Universities/institutions working in areas of interests is necessary. The Department of Environment proposes to selectively support such groups in priority areas of environmental science and management, such as eco-system, environmental education, mine environment studies, etc. The Ecological Research and Training Centre is one such centre already functioning at the Indian Institute of Science, Bangalore.

(h) *Environment Information* : The scheme for setting up of the Environmental Information System with a national network of distributed information centres and a focal point in the Department of Environment was approved in the Sixth

Plan Period. It has become operational through the installation of a Computer Terminal linked with a computer system of the National Informatic Centre to serve as the focal point facility for storage, retrieval and dissemination of information to the users. Distributed Information Centres were set up at the Industrial Toxicology Research Centre, Lucknow, the Central Board for Prevention and Control of Water Pollution, New Delhi and seven other centres for information services in specific subject areas. Centres in respect of other subject areas are being set up.

(i) *Pitamber Pant National Environment Fellowship* : The Pitamber Pant National Environment Fellowship Award was constituted by the Government of India in 1978 to encourage and recognise excellence in any branch of research related to the environmental sciences.

National Wasteland Development Board

The National Wasteland Development Board was set up in May 1985. The main purpose and functions of the Board are : To coordinate and catalyse programmes which would enable the country to achieve a target of planting five million hec. a year; to increase tree and other greencover on wastelands; to fulfil fuelwood and fodder needs of the people; to develop a people's movement for afforestation; to formulate programmes for the management and development of wastelands in the country; to review the progress of implementation of programmes and schemes for the development of wastelands by different agencies within and outside the Government; and to promote and encourage active involvement of non-government organisations and public at large including the landless in wastelands development.

Central Ganga Authority

A comprehensive survey of the Ganga basin by the Central Board for Prevention and Control of Water Pollution revealed that the river, despite its extraordinary resilience is heavily polluted at several places. Such a situation calls for immediate action specially because of the fact that 80 per cent of the

diseases are water-borne. Therefore, the Government of India constituted the Central Ganga Authority in February, 1985 to evolve a long term programme for restoring the quality of the river.

Ganga flows through eight States namely Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, West Bengal and the Union Territory of Delhi. The main source of pollution are urban and industrial wastes from 29 class-I cities (*i.e.*, those having population over 1 Lakh) 23 class-II cities (*i.e.*, those having population between 50,000 and 1 lakh) and about 48 towns (*i.e.*, those having population of less than 50,000). These towns are located along the 2,525 kms stretch of the river from Gangotri to Ganga Sagar. It has been estimated that about 75 per cent of the pollution of the river is caused by municipal wastes, particularly by untreated sewage. By diverting and treating such wastes in the class-I towns located on the banks of the river, there will be an immediate reduction in the pollution load. For this purpose the Action Plan includes the following measures : Renovation of interceptors to divert flow of sewers and other liquid wastes into Ganga; renovation of existing sewage pumping stations and sewage treatment plants and installation of new sewage treatment plants to recover the maximum possible resources especially bio-energy to operate the pumping and treatment plants and derive maximum possible revenue; biological conservation measures based on proven techniques; and other sanitation schemes.

While the Ganga Action Plan with primarily focus on the control of pollution from domestic sources, it will also address itself to other important issues such as maintenance of the minimum flow in the river in the context of the Ganga Action Plan; and pollution from industrial sources.

The types of schemes under the Action Plan can be classified broadly in three categories : (a) Schemes for diversion of waste water including renovation/installation of interceptors and pumping stations; (b) Schemes for the renovation or installation of sewage treatment plants including bio-energy and other resources-recovering components as feasible; and (c) Other schemes for low-cost sanitation, facilities for river front and biological conservation.

Environment Act

The Lok Sabha on May 9, 1986 adopted the environment (Protection) Bill, 1986, which makes contravention of its provisions a punishable offence initially with five years imprisonment or a fine of upto Rs. 1 lakh. The following are some of the salient features of the 26 clauses : Prohibits carrying on of any industry operation or process which discharges or emits any environmental pollution in "excess of the standards laid down; enjoins upon persons to comply with the procedures laid down and safeguards prescribed under the rules in the handling of hazardous substances; provides for imprisonment upto five years or fine of Rs. one lakh "or both" for the first offence and additional fine of Rs. 5,000 for every day for continuing contravention and an enhanced prison sentences for a term which may extend to seven years where the contravention continued beyond a period of one year "after the date of conviction," fixes criminal liability also on the directors and principal officers of a company where an offence is committed by a company; lays down that no court shall take cognizance of any offence under this legislation except on a complaint made by the Centre or any authority or officers authorised in this behalf or by person who has given notice of not less than 60 days of his intention to make a complaint, if within those 60 days the government or officers has itself or himself not made the complaint and has not communicated to such person its or his refusal to make such a complaint.

Approach During Seventh Plan : The need to conserve natural resources and environment quality particularly to prevent damage to fragile and irreplaceable eco-systems has been increasingly reflected in national policies for over a decade. All future development programmes must take environmental consideration fully into account. Towards this end, environmental factors and ecological imperatives will have to be incorporated into the design of all developmental projects from the very commencement of their planning. All activities which might cause loss of environmental quality or unacceptable damage to eco-systems will have to be carefully regulated. Planning and implementation of projects should be designed to minimise

environmental disruption such as the loss of genetic diversity, pollution of the nation's air and other environmental problems which might threaten health and well-being. Environmental planning must now be projected to achieve a sustainable development as well as ensure a quality of life.

Afforestation programmes, both in plains and hills, need to be stepped up to outpace the rate of denudation. Such programme can be a major sources of employment and income for the poor, apart from providing fuel and fodder for meeting local needs. Such programmes also contribute to soil conservation. In this context, the integrated management of resources on a watershed basis in hill areas with the participation of the people needs to be given high priority.

The plan thus has accepted Environmental Management as a major guiding factor for national development. The term Environmental Management encompassing environmental planning, protection, monitoring, assessment, research, education, conservation and sustainable use of resources envisage an investment of Rs. 47.91 crores during Seventh Five-Year Plan (1985-90) as compared to Rs. 40.05 crores during the Sixth Five-Year Plan (1980-1985).⁸

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Drought, Development and Desertification

N.D. JAYAL*

1. The Silent Crisis in Need of Attention

Before it is Too Late for India

In the recent and recurring, which affected almost half of the country, there has been unprecedented human misery, loss to animal wealth and destruction of agricultural production. If proper attention is not focused on this threat without further delay, the situation in this part of the world too may become as serious and disastrous as it is in Africa today.

Drought is a meteorological phenomenon of dry spells resulting from departure of rainfall from normal. The seasonal monsoonic climate with rainfall concentrated within two or three months in the year and variable from year to year, must necessarily be accompanied by erratic and long dry spells. In areas like Gujarat, Rajasthan, Andhra Pradesh, Karnataka, etc., the rainfall is so highly deviant that a 'drought' situation can be shown in any district in any year. Naturally evolving vegetation, indigenously adapted cropping practices and water management techniques have all evolved over centuries to cope with such variations and maximise conservation of water so that adequate water is available on the surface, in the sub-soil

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and as ground-water to maintain plant, animal and human life on a sustainable basis in the drought-prone areas. Indications are clear, however, that the temporary phenomenon of meteorological drought in India is tending to be converted into the permanent and pervasive phenomenon of desertification, undermining biological productivity of soil over large parts of the country. Desertification trends in India are not restricted to the fringes of the existing deserts only. Desertification is often starting as a patchy destruction of productive land through inappropriate land use occurring in areas which, from a strictly climatic point of view, should not face the threat of desertification. Since the large majority of people in India have livelihoods based on land the long term decline of the biological productivity of land undermines livelihoods and results in economic underdevelopment.

In the last few decades, especially in the last 20 years, the vulnerability of larger and larger parts of the country to drought has kept on increasing and desertification trends have set in. The control of human misery and economic losses resulting from drought and desertification is possible only when the ecological roots of this increasing vulnerability are properly identified.

Desertification Through Inappropriate Development Projects

Is Rainfall Failure the Primary Cause of Scarcity?

Micro-analysis from different regions of the country reveal that scarcity of water, fodder are occurring systematically over a longer timespan and even during years of normal rainfall. Over the last few decades there have been accelerated changes in the agricultural land and water-use, as well as in the state of the tree cover in the country. Many of these changes are brought about through the official development programmes that are insensitive to the requirements of ecological stability. While no significant macrolevel climatic changes can be inferred from the meteorological data, development activity contributing to the destruction of natural forest cover can significantly change microclimatic factors and local moisture conditions.

Cropping Patterns and Vulnerability to Drought

Meteorological drought in the arid and semi-arid regions of India being a regular phenomenon, the evolution of agriculture should be guided by the objective of increased resilience and minimisation of risks of crop-failure. Conventional paradigms of agriculture development ignore this vulnerability of arid and semi-arid regions and, through simplistic attempts at increasing production in the short run, undermine biological productivity and the condition for sustainable production in the long run. While increased exploitation of scarce water resources through well irrigation or canal irrigation has been put forward as a protection from this vulnerability of the drought-prone areas by the conventional paradigm, the water intensive cropping patterns arising from over-exploitation of water resources have themselves introduced new vulnerabilities and converted drought-prone regions to desertified ones.

Groundwater Mining and Desertification

The situation in Maharashtra, where there has been no recovery from drought since 1972, indicates that over-exploitation of water for water demanding sugarcane cultivation is the primary cause for the growing scarcity of water for drinking and protection from reported failure of food-crops. While the government cites drinking water scarcity as the reason for increased grants for water development and the failures of foodcrops for drought relief, the cultivation and production of sugarcane expanded.

Destabilised water cycles are among the most serious ecological factors behind desertification. Hydrological imbalance in seasonal rainfall conditions arises from the changes in proportion of water lost immediately as surface run-off, and water retained in the soil through infiltration and as groundwater through percolation. Increased instant run-off resulting from bad land-use amounts to decreased water availability in the lean season.

Most official water development projects in drought-prone regions fail to see ground-water storages as ultimately needing to be recharged at the surface. Water use policy in the drought-

prone regions has encouraged increased withdrawal of groundwater much beyond recharge rates. This has caused groundwater mining, and drying up of surface tanks, shallow and deep wells, increasing the level of human misery

Indigenous Knowledge in Control of Drought and Desertification

Indigenous land and water use systems, cropping patterns, livelihoods and life-styles, have evolved over centuries to match the endowments and vulnerabilities of the total eco-systems. The systems of mixed cropping were carefully selected to optimise production while minimising risks of crop failure. Rainfed farming, for instance, has planted millets like 'ragi' with mixed pulse crops like 'togari' or 'avare'. By this practice the best use is made of rainfall. If the rains are unfavourable for 'ragi' they are often beneficial for other crops. As a result a total crop failure is avoided even under poor or untimely rainfall. Crop production based on indigenous knowledge that provided insurance against drought and desertification, thus depended on a great amount of genetic variety of crops that were carefully chosen and improved over centuries of field-testing.

Misconceptions and Mismanagement of Drought and Desertification

Like all major ecological problems, a systematic understanding of drought and desertification is difficult. As a result, shallow and sometimes erroneous descriptions have led the programmes for their control. The most fundamental misconception in drought management is the assumption that any general scarcity of water, either as surface run off drought, soil moisture drought and aquifer drought, which are associated with desertification, are the same as meteorological drought, whereas, in fact, they are distinct. Scarcity of moisture for plant animal and human life is not necessarily always connected with scarcity of rainfall. The former is a man-made scarcity often associated with misguided attempts at development in agriculture, forestry or water resources.

Action for Desertification Control

There is an urgent need for people and planners to recognise desertification which arises from ignorance of natural processes of renewability of soil-water-vegetation systems. Meteorological drought cannot be controlled by man. But desertification, being the result of resource ignorant human intervention, can be reversed through enlightened human efforts. One such living example is the Auroville Greenwork.

The central role of reafforestation with appropriate tree species was unquestionably recognised as the most important step against desertification. The total commercialisation of afforestation projects may lead to green deserts. The case of Kolar district in Karnataka makes interesting reading. The district which is the most 'successful' one in social forestry, with large expansion of Eucalyptus cultivation on private farmlands with World Bank aid, is also the district with the most severe drought conditions and fodder scarcity. All the 11 talukas of the district are affected by drought and the majority of them are officially classified as severely affected. It is thus important to notice that defense against drought and desertification is not always provided by enhanced tree cover *per se*.

The Seminar continued that sacrifice of ecological requirements for the lure of short-term unsustainable increase in cash income, through processes such as uncontrolled and excessive use of groundwater, will accelerate the process of desertification. Strong legal steps should be evolved to stop the exhaustion of underground water resources.

The immediate Task

The threat of desertification and its most acute expression through famine may become a real and massive one in the years to come. Management of drought, accordingly, calls for immediate attention and deserves the highest priority. There is a great opportunity to fight desertification through programmes, such as social forestry and wasteland development, only if the ecological requirements of natural processes are understood and reflected in this programmes. Accordingly both these programmes should give the highest priority to the generation of

inter-disciplinary ecological knowledge on the relationship between soil, water and vegetation. Tree planting, *per se*, without such understanding will either be doomed to failure or the ecologically destructive through pure commercial orientation and neglect of ecological factors.

Development projects, specially in agriculture, in a similar manner, need to be reoriented towards sustainability and ecological stability. Science was largely ignored in many agricultural changes which made the newly introduced agricultural practices highly vulnerable to drought. Taking advantage of the resilience built into indigenous crop varieties and cropping patterns, and the wisdom of indigenous land-water-soil management techniques in the drought prone areas, inter-disciplinary scientific knowledge should be used to formulate new development programmes so that these can be sustainable and productive.

Such a knowledge system and the functioning organisational structure can be ensured when officials and experts recognise the place of local population and wisdom in the formulation, execution and monitoring of drought-proofing projects. Administrative reforms to ensure ecologically sound and socially just natural resource use is long overdue. The various institutes of management and technology in the country and the large number of research and training organisations should immediately start working on these very relevant social and economic issues. Every passing day is a step closer to disaster. The Seminar urges governments, both at the Centre and in the States, that relief cannot be the solution to ever-increasing suffering from drought. The solution lies in ecological stability against drought and desertification—This task is too large and too urgent to be left to the official machinery alone.

Socio-Economic Issues of Human Environment at the International Level

R.K. SAPRU*

Introduction

International approval for the environmental protection was given by the 113 nations attending the 1972 Stockholm United Nations Conference on the Human Environment. Since then the environment has moved into the mainstream of issues that concern the entire international community. Such terms as 'eco-development', 'ecological security', 'sustainable development', 'environmentally sound development' have come into wide-spread use focusing our understanding of the relationship between environment and development that without conservation we cannot have development, and without development we cannot have conservation. But how much is the understanding of this principle understood? How far have we been able to fulfil the Stockholm intent to "safeguard and enhance the environment for present and future generations of man?" How successful has UNEP been in persuading the decision-makers to safeguard the environment.

Today the environmental issues are central to the political, economic and social issues which constitute the mainstay of the

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dialogue between and among developed and developing countries. Halting and reversing ecological degradation which now assumes emergency proportions, has been identified as a major priority in a growing volume of major national and international studies and reports. No development which does not find a solution to the cause of environmental impoverishment is worthy of the name. The Independent Commission on International Development Issues (1983) made strong references to this concern by stating: "Growing pressure on land, increasing use of chemicals, desertification and deforestation are reducing the productivity of soils in many parts of the world."¹

Earlier the United Nations Group of Governmental Experts stated in its final report: "There can no longer be the slightest doubt that resource scarcities and ecological stresses constitute real and imminent threats to the future well-being of all peoples and nations. These challenges are fundamentally non-military and it is imperative that they be addressed accordingly."² The World Environment 1972-82, prepared by the United Nations Environment Programme to commemorate the tenth anniversary of the Stockholm Conference, revealed that environmental concerns in general, and population and environment relationships in particular, had not been squarely dealt with by development models.³

Consequently the 1984 International Conference on population pronounced that "priority should be given to action programmes integrating all essential population and development factors, taking fully into account the need for national utilization of natural resources and protection of the physical environment and preventing its further deterioration."⁴ A similar recognition of the interdependence between population, environment and development has been reflected in the regional development planning of several centrally planned economies,⁵ and the environment policy statement of the United States Agency for International Development (USAID).⁶

These and other reports⁷ have brought this generation to a greater awareness and understanding of the interdependence between the nature and the man. Research advances in environmental monitoring and biological sciences combined with harsh experience in international economic development, have

drawn the world community to an attention that its own health and well-being and the fate of future generations depend on action to avert environmental catastrophe. This new understanding has helped to bring into sharper focus the interrelatedness of the environment. The purpose of the article is to engender a broader appreciation of the central role of environmental issues in the wider socio-economic context. It is meant to facilitate a more comprehensive approach by demonstrating that economic problems cause environmental despoliation which, in turn, makes economic and structural reforms more difficult to achieve. Breaking the vicious circle requires increasingly attention from nations in their approach to international environmental co-operation. There is increasing evidence that sustainable development is not realizable unless emphasis is placed at a very early stage on the relationship between the environment and human society and its development. The components of the natural world-forests, air, water, soil, the sea and so on, together made up the system which supports all life on the earth planet. And it is strange that human being is seen abusing this life-support system on which his survival and future generation depend. The focus of concern has come increasingly to rest on the consequences of human activities on the natural environment. The aim of environment is to ensure that country's development and conservation of natural resources are pursued as goals of equal importance. What is required is to restrict excessive or wasteful consumption of resources through alternative life styles and development patterns.

In this Chapter an attempt is made to discuss some issues of concern which have negative effects on the human environment at the international level.

Arms Race

The first is the arms race between and among developed and developing countries. To indicate the magnitude, the expenditures on arms by the developed countries were raised from \$ 312.4 billion in 1970 to \$ 344.7 billion in 1978 compared with 69.9 billion to \$ 102 billion of the corresponding period

by the developing countries. On the contrary, the expenditures on health were \$ 22.5 billion for the developing and \$ 213 billion for the developed countries in 1978.⁸ If expenditures on arms could be reduced, those resources could then be used to deal with furthering human welfare.

The arms race and military operations not only consume natural as well as manpower resources but also have an extremely negative effect on the human environment. Whereas industrial despoliation of the environment has been the focus of attention of many western scientists, environmentalists and public figures, pollution associated with war and the arms race is not accorded the priority it deserves on the part of the majority of them. Yet this is a serious issue. The nuclear explosions in the atmosphere which were widely undertaken by the western powers in the 1960s, notably heightened the level of radioactive radiation of all living beings on the planet of earth in contrast to the level caused by the natural content of radioactive substances which are always found in the atmosphere. Biologists are of the conviction that radioactive radiation causes specific illnesses, lowers the body's resistance to many diseases and results in various mutations and deformities in the future generations.

Special international conferences of experts need to be convened to consider the issue. It may be emphasized that the use of nuclear weapons in a world conflict would lead to ecological disasters not only on the territory of the belligerents but also throughout the rest of the world.

Mass Poverty

Poverty is an alarming environmental problem. According to FAO (1983) nearly half the rural population of the developing world lives below the official poverty line. Poverty not only degrades human environment but also obstructs development. Lack of potable drinking water for over 1,300 million people and of sanitation for over 1,700 million is by far the most important cause of environmental pollution resulting into 25,000 deaths a day and 80 per cent of world diseases.⁹ Further inadequate shelter and the slum dwellers on the rapidly growing urban areas of the developing world increase vulnerability to en-

vironmental crisis. Growing pressure on land, removal of forest cover, incautious use of chemicals and fertilisers and soil erosion reduce the agricultural potential of scarce land resources causing further increase in poverty. A vicious circle starts because, unless development results in the level of employment, income and productivity, the extent of absolute poverty cannot be reduced in a sustained manner, while the persistence of mass poverty places severe pressures on natural resources and public services and infrastructure. There is thus a race between development and the distinction of environmental resources. The starting point must be to provide for the establishment of the economic means needed to deal with issues of water, nutritional and human settlements of the poor in the developing world.

Population Pressure

Poverty also contributes to human population pressure. The poor and village dwellers have a major stake in the larger families.¹⁰ They see in the largest possible family a chance of security in old age. Although the mortality rates have come down through the impact of technological innovation, birth rates have continued to follow a traditional pattern owing to a lack of economic development. Population growth is outpacing the capacity of the majority of developing countries to provide for their economic and social well-being. The pressures thus generated are depleting natural resources faster than they can be regenerated, resulting into reduction in productivity and underdevelopment. The International Conference on Population held at Mexico City in August 1984 observed that "in many countries the population has continued to grow rapidly, aggravating such environmental and natural resources problems as soil erosion, desertification and deforestation, which affect food and agricultural production."¹¹ In a large conference number of developing countries, notably in Africa, rapid growth of population over the previous decade has been accompanied by a gradual decline in average levels of living as reflected in per capita incomes. It has also been accompanied by a decline in the quality of life, as measured by such parameters as per capita availability of food and nutrition, drinking-water and

sanitation. Environmental conditions in rural as well as urban areas in majority of the developing countries have deteriorated as their populations have grown. Plainly speaking, the quantity and quality of natural resources which provide the basis for sustained development, have steadily declined.¹²

It may be emphasized that the intended demographic transition to population equilibrium, as defined by low birth and death rates and high life expectancies, may not come about unless coordinated measures are taken based on a recognition of the interdependence between population, development and environment. A major goal of policy makers in all three fields should be to achieve an improved quality of life with sustainable use of the natural resources base.

Inappropriate Agricultural Practices

Agricultural development in the developing world provides food for human sustenance and employment for growing population but it does not maintain sustainable production. While the world as a whole producing enough food to meet the present need of world's population (5 billion), the inequality in food distribution leaves millions of people near the subsistence level. F.A.O. has estimated that 450 million people in developing countries were seriously under-nourished in the mid-1970s, and if present trends continue the figure will be 600 million in the year 2000.¹³ It has also estimated that by that year a world population of more than 6 billion will require an agricultural output some 50 to 60 per cent greater than in 1980.¹⁴ Increasing pressures to expand the land, cultivation on steep hillsides and increasing rates of deforestation have led to soil degradation, decline in productivity and desertification. It has been estimated that about 22,500 million tons of soil is lost to the world every year.¹⁵ Further the draining of inland wetlands for conversion to agricultural uses can have serious effects on fish, wildlife and wetland habitats. Further excessive irrigation wastes large amounts of water and creates problems of salinization and alkalization, which in turn, have damaged millions of hectares of productive lands. In several parts of the world especially in the developing countries, badly designed irrigation schemes have often created favourable environments

for such water-borne diseases as schistoromiasis, liver fluke filariasis and malaria. Besides contributing to health hazards, dams constructed for irrigation and other purposes pose other environmental problems.¹⁶ Again excessive use of ground water for irrigation has led to the depletion of resources in several developing countries. Besides ground water in many regions has been contaminated with nitrates, which if present in excessive amounts in drinking water or food, may pose hazards to health hazards.¹⁷ The protection of crops from pests and diseases requires the use of pesticides. However, the continued large-scale use of pesticides has created a number of environmental problems. Chief among these problems are pollution of soils through pesticide residues, contamination of surface and ground water, extinction of many insect, bird and other species, contamination in human food-chains, and the resurgence of some diseases, such as malaria.¹⁸ Further farm mechanization in several developing countries in which draught animals are replaced by machinery not only involves high costs but also leads to the decline of inputs of animal droppings which are valuable organic fertilizers. Throughout the world, farm crops level substantial agricultural residues, the extent of which is not appreciated very much. Over the world as a whole, about 1,700 million tons of cereal straw and 50 million tons of sugar-cane tops are produced annually, little of which is used.¹⁹ Such residues, may be returned directly to the soil, but in many developing countries maize, rice and wheat straw and sugar-cane residues are burnt, with a loss of the nutrients they contain and the creation of air pollution. A marked impact of green revolution has been the shift of farmers in some developing countries, from the cultivation of traditional native crops to the new HYVs to increase agricultural productivity. This increasing neglect of native crops has, however, caused nutritional problems in some areas, and has also led to a marked decrease in genetic diversity.

The economic demographic and environmental trends recorded in the 1970s and mid-1980s indicate that if widespread improvements in human nutrition are to be secured, there is a need for a reordering of social and economic priorities. A high priority is needed to be accorded to agricultural and family planning practices, specially in the developing countries which

could set the world on a path that will reduce hunger and malnutrition.

Debt Burden

The debt burden and regressive terms of trade are becoming major global issues. Developing countries are facing mounting difficulty in their efforts to find adequate and appropriate resources, particularly foreign exchange to quicken their pace of socio-economic development. This has often forced them to pay attention to short-term aspects without giving serious thought to long-term considerations. Thus, the effect of such international economic issue has been to abridge the gap of co-operation. A one per cent raise in interest rates adds about 5 billion to the debt burden of the developing world.²⁰ The total debt service payments for all developing countries in 1982 were 93 billion.²¹ The debt burden, therefore, places pressure not only on the economic surplus produced by the developing world, but also on resources which have to be over-exploited to ease this burden. For example, for one Latin American country it took 9.8 times as much beef to purchase a barrel of oil in 1981 as it did in 1973. There is mounting evidence that industrialized nations depend on the developing countries as the source of their raw materials, but already the renewable resource base in many such countries has been seriously undermined. Increasing demands on fish resources and tropical forest cover provide two instances. Thus the effect of increase in the size of population and people's patterns of consumption and production has been to create an imbalance between people and resources, causing further increasing environmental degradation. Energy, especially petroleum, is becoming a major global issue due to the growing reliance of the world economy on it. Today the average manufactured commodity in the industrialised nations is being produced with twenty per cent less energy input than a decade ago.²² Now there is increased dependence on coal and on nuclear energy with potential impacts on the human environment. While the developed countries have devised several devices to assess the environmental impacts of the energy, developing countries have just started to give attention to this issue. Indeed, any energy transition must be achieved in

full understanding of the environmental impacts of various forms of energy generation and use.

It would clearly pay governments to coordinate energy and raw-materials policies with environmental policy with a view to securing overall savings through the recovery of wastes. These are net gains besides the gain in environmental quality. Pollution seems to be a function of waste, and already there is mounting evidence to show that private companies are making large profits by retrieving pollutants. For an example, the Japanese Cement industry is currently using 35 million used car tyres a year in the Cement making process. In this way the cement industry is able to save two million kilolitres of imported crude oil.

Imprudent Technologies

Environmental problems also occur because of the inappropriate application of technology. Examples of such problems are toxic wastes, threats to ozone layer, possible climatic change, etc. The economic effects of such problems could be disastrous. The impact of technology on the environment is crucial. While in the developed countries, the capacity to evaluate its impact is growing, only a small percentage of the world scientific and research capacity is found in the developing countries. For developing world to be tied to environmentally imprudent technologies is ultimately counter-productive not only for their environments and economies but also for the global environment.

Increased transfer of technology to developing world should be accompanied by the provision of data which would permit informed choice in the light of local conditions.

Concluding Observations

To summarise the present situation in most developing countries, arms race, acute population pressure, mass poverty, environmental despoliation, natural resource depletion and slow development seem to be interacting with one another in ways that are harmful to both the immediate and the long-term well-being of the people. Although most of the problems remain

confined to the countries in which they originate, in due course they tend to be transmitted directly or indirectly to other countries. The world has the natural resources, technology, expertise and other resources to provide for decent quality of life for the global population. However, there is no automatic mechanism by which the needs of a country to its capacity are met. A basic question today, therefore, is not whether to choose between development and environment. It is how to select patterns of development that not only minimise adverse impacts but are actually designed to stabilise and improve environmental conditions. International economic co-operation is vital in this context. However, this desirable outcome will not be achieved unless nations recognise the crucial relationship between sound environmental management and world economic and social development. What is required is a more integrated approach towards evolving an international environmental system which responds adequately to the development needs of developing countries in the context of growing environmental despoliation. This will help achievement of the demographic transition, especially in area that are experiencing environmental stress and acute population pressure.

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